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EVALUATION OF RECEIVING WATER-BASED TOXICS CONTROL INITIATIVES: FINAL REPORT

Volume Two: Appendices

prepared for:

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APPENDIX A

US EPA WHOLE EFFLUENT TOXICS PROGRAM

The U.S. EPA publicly announced in 1984 a new policy for the development of water-quality-based effluent discharge limits. A central element of the program is the integration of toxicity tests in combination with chemical-specific analyses to set effluent limits and to assess compliance. A "Technical Support Document" (TSD) has been published (Brandes et al, 1984) which describes the details of how the policy will be effected. The following appendix is based to a large extent on the TSD. Part of the TSD has been excerpted directly in this aapendix, however, the entire document and related reports should be consulted for the details of the program. The purpose of this appendix is to highlight the major elements so that readers can obtain a basic understanding of the system. This appendix does not address all matters contained in the TSD, only those of particular relevance to the recommendations contained in Volume I of this report and Appendix C of this volume.

INTRODUCTION

Toxicity testing has been used for many years as a basis to assess the effluents of chemicals and effluents on aquatic life. Several major developments have preceded the institution of whole-effluent toxicity limits. Perhaps the most significant is the standardization of the tests to the points that reliable reproducible analyses can be performed on a routine basis. With this development, it is possible to define, in legally enforceable terms, meaningful effluent limits that are relatively irrefutable from an analytical perspective.

A second major development has been the reconceptualization of the toxic effluent control issue from one pertaining to specific chemicals to that of whole-effluent effects. The use of total or whole-effluent toxicity limits was first formally regulated in Canada under the Federal effluent regulations for the pulp and paper industry (Environment Canada, 1971) but for various reasons, these limits have never been strictly enforced nor have they been applied in regulations, either federally or provincially to other sectors. The U.S. EPA with their water-quality-based toxics control policy has taken a major step toward wide application of whole-effluent toxicity limits. This appendix examines how the water quality-based toxics control program is being implemented from a technical perspective.

The following eight pages are taken directly from the TSD and provide an overview of the basic elements involved in using toxicity limits to regulate toxic effluents.

1. Approaches to Water Quality-based Toxics Control

Two approaches to the assessment and control of toxics are presented in this document: the whole-effluent approach and the chemical-specific approach.

The Whole-effluent Approach

The whole-effluent, or toxicity-based, approach to toxics control involves the use of toxicity tests to measure the toxicity of industrial and municipal wastewater discharges. A toxicity test is a relatively simple laboratory procedure. An effluent sample is collected and diluted in test chambers; usually the dilutions used are 100%, 30%, 10%, 3%, 1%, and a control. Often the receiving water is used to dilute the effluent because it more closely simulates effluent/receiving water interactions. Test organisms are placed in these test chambers for specified periods of time. At various points during the testing period, the number of organisms affected in each chamber is counted (the endpoint can be mortality, lower fecundity, reduced growth rates, etc.) and the lowest effluent concentration that causes that endpoint is calculated. This endpoint concentration becomes a quantified measure of the concentration that would cause instream impact if exceeded for a particular period of time. It is usually stated either as an LC50 (the effluent concentration at which 50% of the test organisms are killed) or a No Observed Effect Level or NOEL (the highest effluent concentration at which no unacceptable effect will occur even at continuous exposure).

The measurement of whole-effluent toxicity can then be used to limit the discharge of toxicants in an effluent. Toxicity itself is used as the effluent parameter. The toxicants creating that toxicity need not be specifically identified or controlled where the effluent's toxicity is limited. An analogy between effluent toxicity and biochemical oxygen demand (BOD) can be drawn. Both are measurements of a biological effect. Both can be quantified. In neither case are the causative agents of the biological effect specifically identified. Thus, whole-effluent toxicity is like BOD in that it is a useful parameter for reducing an undesirable effect caused by the discharge of a complex mixture of waste materials.

Permit limits can be expressed as LC50s or NOELs (e.g., the effluent shall exhibit an LC50 or NOEL of greater than 10%). The proper derivation of such toxicity-based permit limits is described in Section 6. Due to the procedures involved in deriving the toxicity limits and since toxicity involves an inverse relationship (the lower the LC50 or NOEL the higher the toxicity of the effluent), it is better to translate concentration-based toxicity measurements into toxic units (TUs). In this way, the problem of the inverse relationship is overcome and the permit limit derivation process is better served. A toxic unit is simply 100 divided by the toxicity measured:

$$\mathrm{TU} = \frac{100}{\mathrm{LC50\ or\ NOEL}}$$

(where LC50 or NOEL is expressed as
percent effluent in dilution water)

An effluent with a toxicity of 10% is an effluent containing 10 TUs. A very important aspect of toxic units is that there are two different types depending on whether acute or chronic toxicity is measured. The proper expression of toxic units is TU_a and TU_c. TU_a is the measurement of acute toxicity units, and TU_c is a measurement of chronic toxicity units (see the glossary for a definition of these terms). They are not the same measurement and should not be used interchangeably.

Acute and chronic TUs make it easy to quantify acceptable instream toxicity. By setting numerical water quality criteria for acute and chronic toxicity, regulatory agencies can quantify narrative State standards such as the ''no toxics in toxic amounts'' standard common to all State water quality standards. The recommended numerical whole-effluent toxicity criteria are described in Section 2.

The Chemical-specific Approach

The chemical-specific approach to toxics control involves the use of laboratory-generated water quality criteria or State standards to limit specific toxicants directly. The toxicity analysis of those chemicals is done in a comprehensive testing program that, unlike whole-effluent testing, attempts to consider a range of toxic endpoints including human health impact and bioaccumulation. Once a criterion is developed, the number is applied, through an exposure analysis, as a permit limit to ensure that the level of that toxicant is not exceeded after discharge. Fate modeling of the toxicant to estimate its behavior after discharge can be an important step in establishing water quality-based permit limits.

Advantages and Disadvantages of the Approaches

The principal advantages of chemical-specific techniques are:

- Treatment systems are more easily designed to meet chemical requirements because more treatability data are available and treatment engineers and permit writers are more familiar with the procedures.
- The fate of a pollutant can be measured through modeling.
- Chemical analyses, in simple cases, can be less expensive than toxicity testing.
- Specific problem chemicals such as carcinogens or bioaccumulative chemicals can be directly limited.

The principal disadvantages of chemical-specific techniques are:

- All toxicants in complex wastewaters may not be known and, therefore, control requirements for all potential toxicants cannot be set.
- It is not always clear which is the toxic compound(s) in the mixture.
- It can become expensive to measure individual toxicants, particularly where many are present in the mixture. Organic chemicals can, in particular, be costly to measure.
- The bioavailability of the toxicants at the discharge site are not assessed, and the interactions between toxicants (e.g., additivity, antagonism) are not measured or accounted for.

The principal advantages of the whole-effluent approach are:

- The aggregate toxicity of all constituents in a complex effluent is measured, and toxic effect can be limited by limiting one parameter — effluent toxicity.
- The bioavailability of the toxic constituents is assessed, and the effects of interactions of constituents are measured.

The principal disadvantages of the whole-effluent approach are:

- Effluent toxicity treatability data are lacking, and treatment engineers and permit writers are unfamiliar with the procedures.
- Where there are chemical/physical conditions (pH changes, photolysis, etc.) present that act on toxicants in such a way as to "release" toxicity downstream, such toxicity may not be measured in the effluent.
- Properties of specific chemicals in complex effluents (such as bioaccumulation, carcinogenicity) are not assessed.

Since each approach can complement the other, this document has been written to integrate them. This document focuses on the whole-effluent approach as a toxics control mechanism because it is a relatively new process when compared to the chemical-specific approach.

Experience has shown that certain issues can cause unnecessary problems and delays in toxics control because of a misunderstanding of their relative importance or technical merit in a water quality-based permitting situation. This is particularly true for the whole-effluent toxicity testing approach. The following discussion focuses on issues involved in the application of this approach.

Issues Involved in the Toxicity-based Toxics Control Process

Correlation of Effluent Toxicity Measurements to Actual Instream Impact

EPA has devoted much attention to this issue. Considerable criticism has been directed at the use of effluent toxicity tests to assess adverse water quality impact because it had not been shown that levels of effluent toxicity measured in aquatic toxicity tests correlated directly to instream toxicity and corresponding ecosystem degradation.

Research conducted specifically to address this criticism, EPA's Complex Effluent Toxicity Testing Program, has shown that at each of the eight sites investigated to date (Lima, Ohio; Circleville, Ohio; Birmingham, Alabama; Baltimore, Maryland; Waterbury, Connecticut; Enid, Oklahoma; Charleston, West Virginia; and Wheeling, West Virginia), when exposure and potential chemical interactions are assessed, effluent toxicity can be correlated directly to impact in receiving waters [1-8]. This relationship is proving valid in both "unimpacted" sites (Circleville) and "impacted" sites (the other sites listed above).

There is a growing consensus among aquatic biologists that an evaluation of effluent toxicity, when adequately related to instream conditions, can give a valid assessment of receiving system impact [9].

This is also true in the application of chemical-specific water quality criteria for toxicants. Provided exposure is adequately assessed, measured instream concentrations of individual chemicals exceeding established safe concentrations can be considered to cause unacceptable impact to the receiving system.

Toxicity Test Method Precision

Considerable concern has been expressed about the precision and reproducibility of toxicity tests because it was believed that the tests themselves exhibited a large inherent variability. Research into this issue by various groups has shown that toxicity test methods, where properly followed, exhibit an acceptable range of variability [10-18]. This variability is similar to test method variabilities exhibited by accepted analytical procedures for individual chemicals.

On-site vs. Off-site Toxicity Testing

Comparisons of toxicity data between tests conducted on-site to tests conducted off-site on samples shipped to Environmental Research Laboratory (ERL)-Duluth via airfreight have shown little variation. For many effluents, on-site or off-site test data do not appear to be significantly different. The major consideration is practicality.

Flow-through toxicity tests require a continuously pumped sample. If it is determined that flow-through tests are needed, on-site testing may be mandatory.

Cost should be weighed against data needs to make this determination. If it is not considered important to the analysis of toxic impact, off-site testing (which is cheaper and can result in the generation of more data) is as acceptable as on-site testing.

Flow-through vs. Static and Renewal Toxicity Testing

A flow-through toxicity test is often conducted using a diluter system and a continuous feed of effluent and dilution water. A static toxicity test is conducted in test chambers, without a serial diluter delivery system, into which effluent and diluent are added manually. Only one test sample is added at the beginning of the test. A renewal toxicity test uses the same delivery system as that of a static test but the test solutions are changed on a pre-determined schedule.

There are several factors to consider in making the choice of test system: what type of toxicity is being measured (is the wastewater highly variable or not; continuous or intermittent discharge?), how much data need to be obtained (variable effluents may require more data), and expense. Each testing method measures effluent toxicity. However, on-line continuous flow-through testing can catch "peaks" of toxicity (should they occur during the testing period) in variable effluents whereas static or renewal tests have a lesser probability of doing so.

Cost is also a factor. Flow-through tests are more resource intensive and require complex delivery systems. Consequently, less data can be generated than with static or renewal testing. Where more data at less cost are desirable, static or renewal testing is probably more appropriate.

Variability

There are three important sources of variability in a water quality impact analysis:

- Effluent variability caused by changes in the composition of the effluent.
- Exposure variability caused by changes in flow rates of both effluent and receiving water. There are also variable receiving water parameters that are independent of flow, such as background toxicant levels, pH, suspended solids, hardness, and temperature, that can be important in assessing impact.
- Species sensitivity variability caused by the differences in response to toxicants between species.

Effluent Variability

Effluent variability can be handled by a proper sampling and testing procedure. Different sampling techniques will result in the measurement of different aspects of toxic impact. For example, composite samples tend to smooth out peaks of toxicity but do stand a better probability of sampling those periods of peak toxicity. Grab sampling will measure peak toxicity but only if the sample is taken during that period of peak toxicity. Since this period may be very short, there can be a low probability of catching that peak. The probability will increase by requiring analysis of more grab samples.

Sampling measurements should be tailored to that toxicity measurement of importance and the need to design testing that accounts for effluent variability. Section 3 describes recommendations for testing frequency designed to assess variable effluents. Appendix B details suggested sampling procedures.

Exposure Variability

Exposure variability is a complex factor that can be addressed in two ways. A simpler, more easily applied approach is to assume a steady state exposure condition (usually an estimate of presumed "worst case" exposure using a low critical receiving water flow and a typical effluent flow).

A second method is to attempt to estimate or actually measure the variable exposure state at the discharge site. This requires statistical analysis and some form of dynamic modeling. Section 5 of this document describes appropriate exposure assessment procedures.

Species Sensitivity Variability

Different species exhibit different sensitivities to toxicants. Often several orders of magnitude difference exist between the least sensitive and the most sensitive species when they are exposed to a particular toxicant. This range varies greatly and can be narrow or wide depending on the toxicant involved. Therefore, generalizations about sensitive and non-sensitive species when considering effluent toxicity are difficult to make.

Trout are considered sensitive organisms requiring high quality water. This generalization is almost universally accepted. When dealing with toxicity, however, this generalization may be inaccurate. Trout are very sensitive to oxygen depletion but may be relatively insensitive to certain toxicants. *Daphnia magna*, a very sensitive test species when exposed to many toxicants, is relatively insensitive to exposure to the pesticide endrin. Bluegills are very resistant to metals, particularly copper. Conversely, they are in the sensitive range of test species for organophosphate pesticides. Figures 1-1, 1-2, and 1-3 graphically show these differences in species sensitivities to hexavalent chromium, dieldrin, and an effluent from a publicly owned treatment works (POTW), respectively. The wide range between sensitivities for the different test species is shown. Comparing the figures shows that the fish and the invertebrates shift relative sensitivities to the toxicants. The fish are less sensitive to chromium but more sensitive to dieldrin. For the cladocerans, the reverse is true. A comparison of species sensitivities to individual toxicants has recently been published [19].

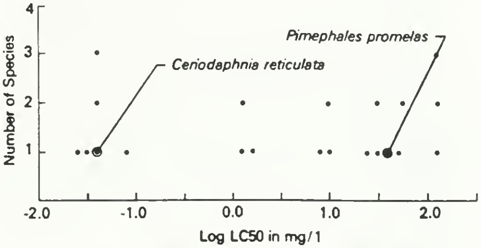


Figure 1-1. Log of LC50s of freshwater species exposed to hexavalent chromium.

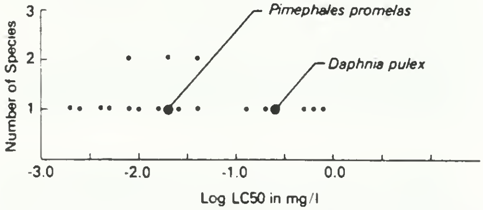


Figure 1-2. Log of LC50s of freshwater species exposed to dieldrin.

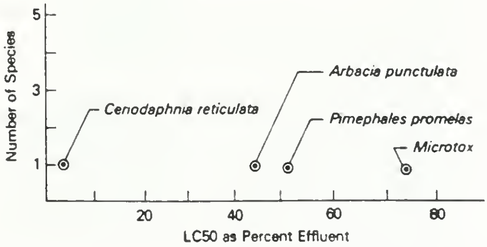


Figure 1-3. LC50s of freshwater and saltwater species exposed to a POTW effluent.

The primary goal in establishing a toxicity testing requirement for a discharger is to find a sensitive test species. The indigenous biota exposed to that effluent in the receiving water are likely to exhibit a lesser sensitivity to that effluent than the sensitive test species and will be protected so long as that test species' no effect level is not exceeded.

Since the measured toxicity of an effluent will be caused by unknown toxic constituents, the relative sensitivities of the test species will also be unknown. Therefore, *proper effluent toxicity analysis requires an assessment of a range of sensitivities of test species to that effluent.* A knowledge of the range is necessary so that the regulatory authority can identify a test species among the different species tested that is truly sensitive relative to the indigenous biota. The only way to assess the range of sensitivities is to test a number of different species. To determine how many species to test, cost must be balanced against reducing scientific uncertainty.

Analysis of species sensitivity ranges found in the national water quality criteria documents indicates that if tests are conducted on three particular species (*Daphnia magna*, *Pimephales promelas*, and *Lepomis macrochirus*), the most sensitive of the three will have an LC50 within one order of magnitude of the most sensitive of all species tested [20]. This was found to be true for 71 of the 73 priority pollutants tested with four or more species.

To best balance cost with toxicological certainty, *EPA recommends three species be considered the number of test species needed to eliminate a sufficient portion of the uncertainty for this factor.*

Often, regulatory agencies have been requiring testing on resident species under the assumption that such tests are needed to assess impact to local biota. However, standard test species, which are easier to test than resident species (based on availability, etc.) will be representative of expected impact on resident species in most cases so long as the range of sensitivities is assessed and a sensitive test species is identified. Resident species toxicity testing is not recommended unless it is required by State statute or some other binding factor. Such testing is more costly, more difficult to do, and subject to more variability (disease, age, etc.) than standardized testing.

Acute-Chronic Ratio (ACR)

The ACR expresses the relationship between the concentration of an effluent or a toxicant causing acute toxicity to a species and the concentration of an effluent or a toxicant causing chronic toxicity to that same species (i.e., ACR = LC50/NOEL). It has commonly been used to extrapolate to a "chronic toxicity" concentration using an available acute toxicity data point. The most widely applied ACRs are 20 and 100; that is, chronic toxicity concentration is one-twentieth to one one-hundredth of the acute toxicity level. Commonly, 20 has been used for non-persistent toxicants and 100 has been used for persistent toxicants. These numbers have been used for both chemical-specific and whole-effluent approaches to impact assessment.

This parameter is a source of variability in assessing toxic water quality impact because the ACR varies both between species and, for any one species, between different toxicants. Therefore, to account for such differences, the regulatory authority must apply some ACR to an effluent when faced with a limited amount of toxicity data.

Research on acute and chronic toxicity for effluents shows that ACRs for whole effluents are more often around 10 [1-8]. When dealing with effluent toxicity, EPA recommends regulatory agencies use 10 as an ACR, in the absence of specific information.

This value can be used both to extrapolate to chronic concentrations from acute toxicity data and to set permit limits limiting chronic toxicity where chronic toxicity is not directly measured.

Of course, where acute and chronic toxicity data are available, the ACR can be directly calculated for that specific effluent. With this value, more cost-effective monitoring can be conducted using acute tests only. However, if the effluent's constituents vary, so will the ACR.

Behavior of Toxicants and Toxicity after Discharge

An understanding of the behavior of both single toxicants and whole-effluent toxicity after discharge may be necessary in the application of water quality-based toxics controls. Evaluating the combined effect of interacting toxic discharges may also be important in multiple discharge situations. When evaluating the instream behavior of toxicants and toxicity, certain factors become important.

- Persistence — How long, to what extent in terms of area, and at what level does effluent toxicity or the toxicity of a single toxicant persist after discharge? Is it reasonable to assume that the persistence of both individual toxic chemicals and effluent toxicity is conservative?
- Additivity, antagonism, and synergism — When toxicants or effluents with toxic properties mix in the receiving water, what is their combined toxic effect?

These factors are discussed below.

Persistence

As soon as an effluent mixes with receiving water, its properties begin to change. The rate of change of toxicity is a measure of the persistence. In most cases, the level of toxicity instream will either remain relatively constant (until further diluted by some additional source), or drop as decay processes (photodecomposition, microbial degradation) or compartmentalization processes (sediment deposition, volatilization) occur.

On-site toxicity testing has indicated that the toxicants causing toxicity measured at discharge sites tend to be persistent. There may be little near field degradation of measured effluent toxicity. Effluent toxicity does exhibit far field decay. Typical patterns of progressive downstream decreasing toxicity (similar to BOD decay) have been observed in a number of discharge situations [1-8].

Since mixing zones designated by State standards are usually restrictive enough to render toxicity assessments essentially near field situations, toxicity degradation may not be important in these permitting situations. Toxicity can be considered conservative (non-degrading) in these cases. However, if a permittee believes that his effluent's toxic effect is non-persistent, several measurement techniques can be employed to assess changes of toxicity after discharge.

- The toxicity test itself, when performed with dilution water from immediately upstream, is an analogue of the mixing processes taking place in the receiving water. Rapid chemical reactions that occur in the mixing zone can be expected to occur in the dilution procedure. The effects of varying physical/chemical conditions on persistence cannot be predicted from these results, however. Testing should be performed during critical low flow periods.
- Ambient toxicity testing, as detailed in Appendix C, measures the instream interactions of effluent and receiving water and can be used to assess persistence.
- Artificial "aging" of an effluent by holding the sample on the shelf for a specific period of time is another technique that can be used to estimate persistence.

One disadvantage of the chemical-specific approach is that the bioavailability of the toxicant after discharge is not measured. However, persistence can be modeled and the persistence of specific toxicants can be accounted for in making impact predictions and setting controls.

Additivity, Antagonism, and Synergism

ADDITIVITY

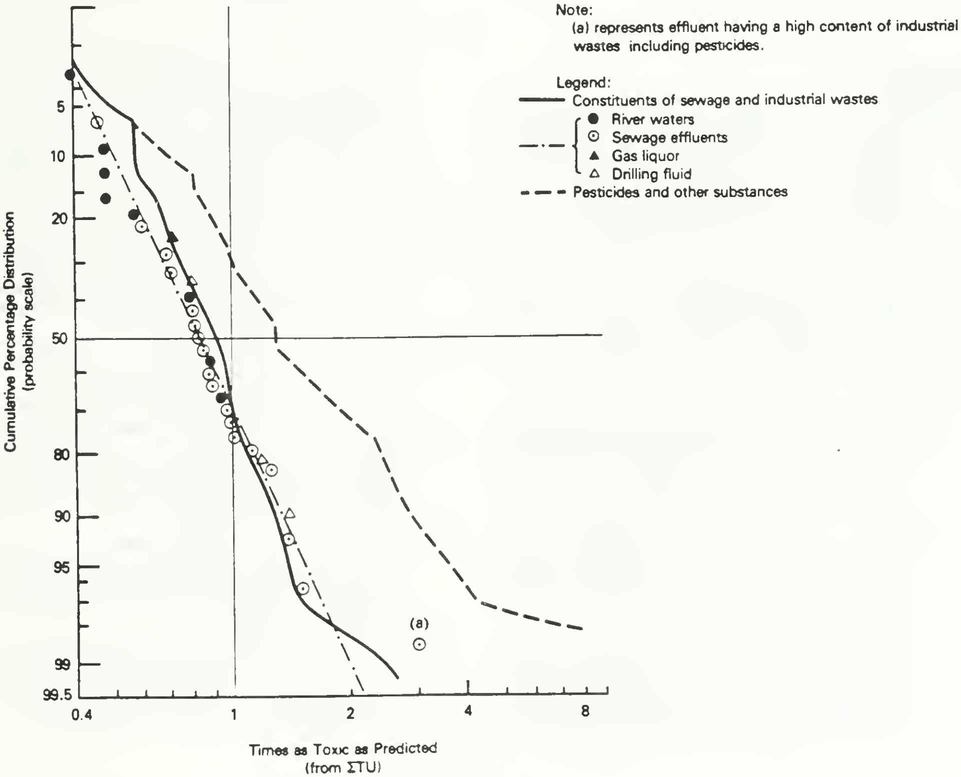
The issue of additivity can be stated as follows: if multiple effluents are discharged to a receiving water, is the toxicity additive in some way? Since each effluent is composed of individual toxic substances, the mixture of effluents in a receiving water (assuming conservative behavior for the moment) produces a mixture of these individual pollutants. The concentrations of each can be calculated from mass balance. Thus, the question of additivity of toxic effluents is the same as the question of additivity of the toxicity of mixtures of chemicals. An extensive review of this question is available [21]. The Chapter 11 summary section is relevant:

> Examination of available data using this [additivity] model shows that for mixtures of toxicants found in sewage and industrial effluents, the joint acutely lethal toxicity to fish and other aquatic organisms is close to that predicted assuming simple addition of the proportional contribution from each toxicant. The observed median value for the joint effect of these toxicants on fish is 0.95 of that predicted; the corresponding collective value for sewage effluents, river waters and a few industrial wastes, based on toxicity of their contituents, is 0.85, while that for pesticides is 1.3. The less than additive effect of commonly occurring toxicants in some mixtures may be partly attributable to small fractions of their respective LC50s having little or no additional effects.

Figure 1-4 illustrates Alabaster and Lloyd's data summary. Over 90% of the data, from the 5 to 95 percentile normalized for "relative" acute toxicity, are within a factor of two of confirming the additivity model. Thus, for acute toxicity at least, mixtures of effluents will probably exhibit additivity in terms of relative acute toxicity.

Little information appears to be available on the additivity of chronic toxicity. For the growth of fish, Alabaster and Lloyd conclude:

> On the other hand, in the few studies on the growth of fish, the joint effect of toxicants has been consistently less than additive which suggests that as concentrations of toxicants are reduced towards the levels of no effect, their potential for addition is also reduced. There appear to be no marked and consistent differences between the response of species to mixtures of toxicants.



Note:
(a) represents effluent having a high content of industrial wastes including pesticides.

Figure 1-4. Data summary on additivity from Alabaster and Lloyd [19].

Additivity appears to supply a reasonable estimate of the combined effects of individual acutely toxic agents. Toxicities approaching the NOEL do not appear additive, however. This suggests that additivity will produce an upper bound of the actual chronic toxicity.

ANTAGONISM

Cases in which one effluent ameliorated the toxicity of another effluent (antagonism) have been observed. If practical, a testing procedure designed to measure such interaction can be employed. A description of such a procedure is found in Section 3, under the heading Multiple Source Discharge Situations.

SYNERGISM

Under certain conditions, synergism, a greater-than-additive increase in toxicity upon mixing, can theoretically occur. However, field studies involving effluent toxicity and laboratory experiments with specific chemicals imply that synergism is an extremely rare phenomenon (it has not been observed during on-site effluent toxicity studies) and may not be an important factor in the toxicological assessment of effluents.

It should be noted that ambient toxicity tests can give some indication of the presence or absence of each of these factors.

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The TSD also deals with issues related to mixing zones, design flows, waste load allocations and implementation strategies. Examples of permitting procedures are presented along with a specific case study. Consideration of these matters have been given in the preparation of the corresponding sections of Volume I.

APPENDIX B

MICHIGAN RULE 57 AND ASSOCIATED RULES

B.1 Introduction

Rule 57, supporting documentation and guidelines[*] and its associated rules set out the procedure used by Michigan to determine chemical-based effluent limits. The procedure is quite comparable in many respects to the system used by the U.S. EPA to set national water quality standards (Stephan et al, 1985; U.S. EPA, 1983a). The major differences between the systems pertain to technical details such as acceptable numbers and types of test results required, etc.

The supporting guidelines for Rule 57 describe a precise and relatively easy-to-follow procedure for setting numerical water quality standards. As a result, this appendix has focussed on this system. However, this should not be construed as an endorsement of the Michigan system over that of the U.S. EPA; rather, the description of Rule 57 will suffice to provide adequate details of how the general system works in both cases.

Central to the functioning of these systems is the identification and resolution of uncertainty associated with available data and the effects themselves. Uncertainty is specifically categorised and used to derive water quality standards. The determination of minimum data requirements and treatment of uncertainty requires careful consideration and are the central decisions relating to the application of these systems. Specific recommendations in this regard are not made. These decisions ultimately are not technical but are essentially ones of public policy, (that is, what is an acceptable level of certainty, safety or risk?). There are many reasons that Ontario might conclude that its acceptable level of certainty (or risk) is quite different than that adopted in the U.S. However, the supporting technical data compiled by U.S. agencies are invaluable in quantifying the level of uncertainty inherent in adopting varying minimum data requirements.

The following appendix first provides a general overview of the structure and decision process embodied in Rule 57. Following is the actual rule and guideline themselves.

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[*] Throughout the remainder of the discussion the term "Rule 57" is used generically to represent not only Rule 57 itself but the supporting documentation and guidelines and associated rules used to set effluent limits.

B.2 System Overview

The following discussion is divided according to the five impact classes used to set water quality criteria, namely:

- i) aquatic chronic toxicity
- ii) terrestrial life cycle effects
- iii) human life cycle effects
- iv) human cancer effects
- v) human hereditary mutagenic or genotoxic teratogenic effects.

Chemical-specific water quality standards are derived by determining for each of these five impact categories the maximum acceptable[*] toxicant concentration (MATC) of the chemical. The lowest of the five maximum concentrations is the used to define the state water quality standard.

Within each impact class, an explicit "decision tree" is set out based on data availability. This process leads to a MATC being calculated for each impact category. Each of the following five sections briefly set out the decision tree used in each impact category. The discussion does not describe the actual mathematical rules and equations; these are contained in Section B.3 which is the Rule 57 documentation itself.

The decision trees for each category are comparable in concept. Alternative calculational procedures are described for each category based on data availability. Minimum data requirements are specified for the use of each procedure. To derive a MATC, one determines the appropriate data availability (or certainty) level and then the specified calculational procedures are applied to the data base resulting in a maximum acceptable concentration for the chemical. Generally, the system starts with the procedures to be used with the most extensive data base and sequentially progresses to those procedures to be used for the most sparse data base. As less reliable data are used , uncertainty factors increase producing more stringent MATCs. This provides an incentive for dischargers to compile more reliable data bases on chemical specific effects.

B.2.1 Aquatic Chronic Toxicity Figure B.1 is a schematic of the decision tree used to derive aquatic chronic values (ACV). The ACV is designed to protect aquatic life in receiving waterbodies. The diagram is intended to provide a general representation of the process and the actual text should be consulted for the details of the decision rules used to select alternative methods according to data availability.

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[*] The acceptability criteria varies by effect category. For example. the No-Observable-Adverse-Effect-Level (NOAEL) may be used for chronic toxicity and a 10^{-6} cancer rate may be deemed accepted for human cancer effects.

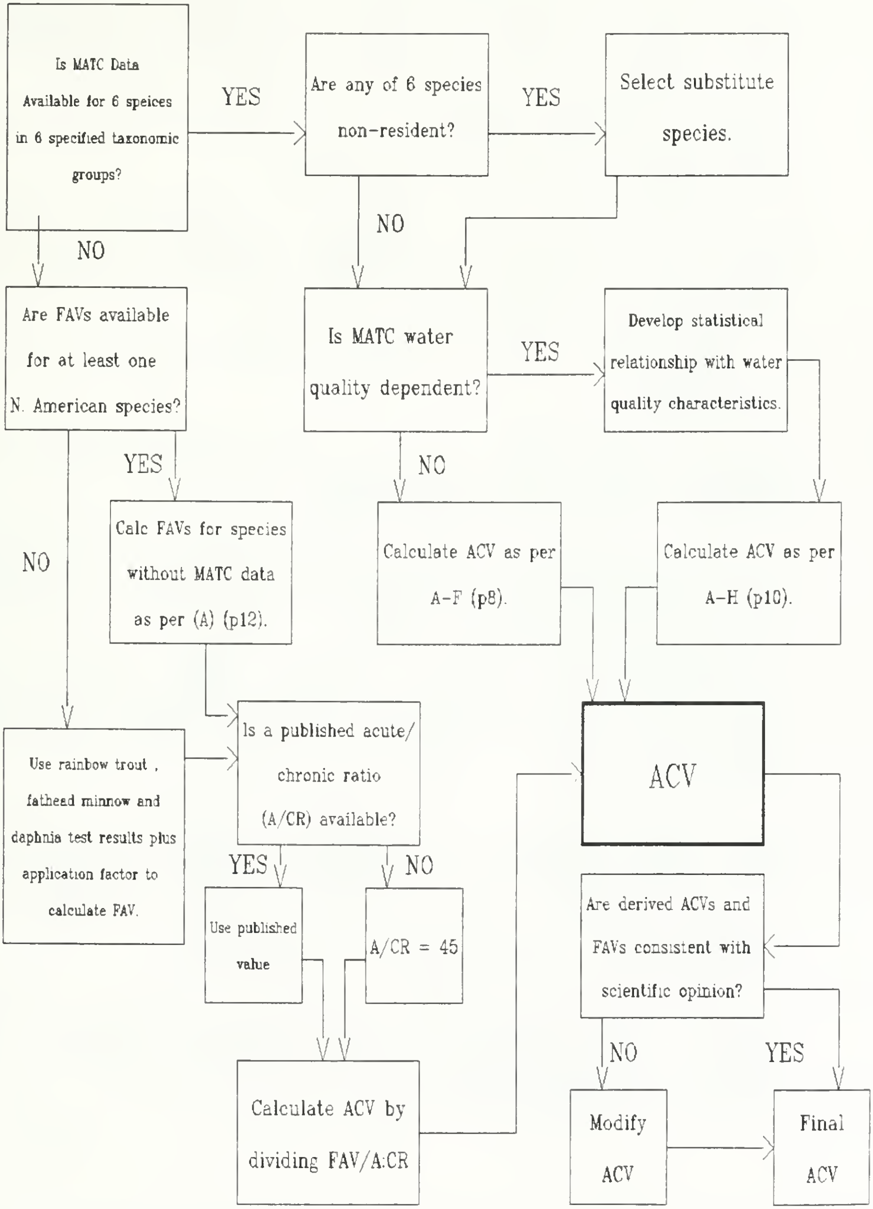


Fig. B.1 Schematic Decision Tree of Calculational Procedure Used to Derive An Aquatic Chronic Toxicity Value (ACV)

Is MATC Data Available for 6 speices in 6 specified taxonomic groups?
YES
Are any of 6 species non-resident?
YES
Select substitute species.
NO
NO
Are FAVs available for at least one N. American species?
Is MATC water quality dependent?
YES
Develop statistical relationship with water quality characteristics.
YES
NO
Calc FAVs for species without MATC data as per (A) (p12).
Calculate ACV as per A-F (p8).
Calculate ACV as per A-H (p10).
NO
ACV
Use rainbow trout, fathead minnow and daphnia test results plus application factor to calculate FAV.
Is a published acute/chronic ratio (A/CR) available?
YES
NO
Use published value
A/CR = 45
Are derived ACVs and FAVs consistent with scientific opinion?
NO
YES
Calculate ACV by dividing FAV/A:CR
Modify ACV
Final ACV

The diagram illustrates basically how an ACV is calculated. Different types of toxicity data can be input to derive the final level. The minimum required to derive an ACV is acute toxicity data for a rainbow trout or fathead minnow and a daphnid. The system is capable of dealing with progressively more and more extensive data as they come available.

B.2.2 Terrestrial Life Cycle Effects The Terrestrial Life Cycle Safe Concentration (TLCSC) is designed to protect terrestrial wildlife. Figure B.2 is a schematic of the decision tree for this factor.

The TLCSC pertains to both mammalian and avian species. It can be derived from various sources of exposure (e.g., ingested water or food). Of particular importance is the inclusion of "uncertainty factors" in the calculations. Their effects can be overwhelming as they may range over more than three orders of magnitude.

The minimum data required to derive on TLCSC are acute oral LD50 results for rats.

B.2.3 Human Life Cycle Effects This set of calculations is designed to deal with public health effects due to threshold effect toxicants. Figure B.3 is a schematic of the decision tree for this factor.

As with the TLCSC, uncertainty factors are used in this calculation. These are increased as the quality of data becomes less. The decision tree provides essentially a priorization of data sources in terms of reliability with the most reliable at the top.

The minimum data required to derive a Human Life Cycle Safe Concentration (HLCSC) are acute oral LD50 results for rats. In the absence of any other information, lowest observable effect level (LOAEL) results or data from other exposure routes may be used at the discretion of the agency.

B.2.4 Human Cancer Effects A differentiation is made in this calculation routine between threshold and non-threshold response mechanisms (Figure B-4). A non-threshold mechanism is assumed unless evidence is available to suggest otherwise. These derived acceptable concentrations are designed to either avoid cancer effects (i.e., for threshold mechanisms) or to ensure the expected increased cancer rate is less than 10^{-5}.

No minimum data requirement is specified for this impact measure. However, a well-defined procedure for the technical review of acceptable concentrations by a scientific advisory committee is established. This committee is essentially parallel in function to the quantitative procedure set up to define acceptable concentrations.

Fig. B.2 Schematic Decision Tree of Calculational Procedure Used to Derive A Terrestrial Life Cycle Safe Concentration (TLCSC)

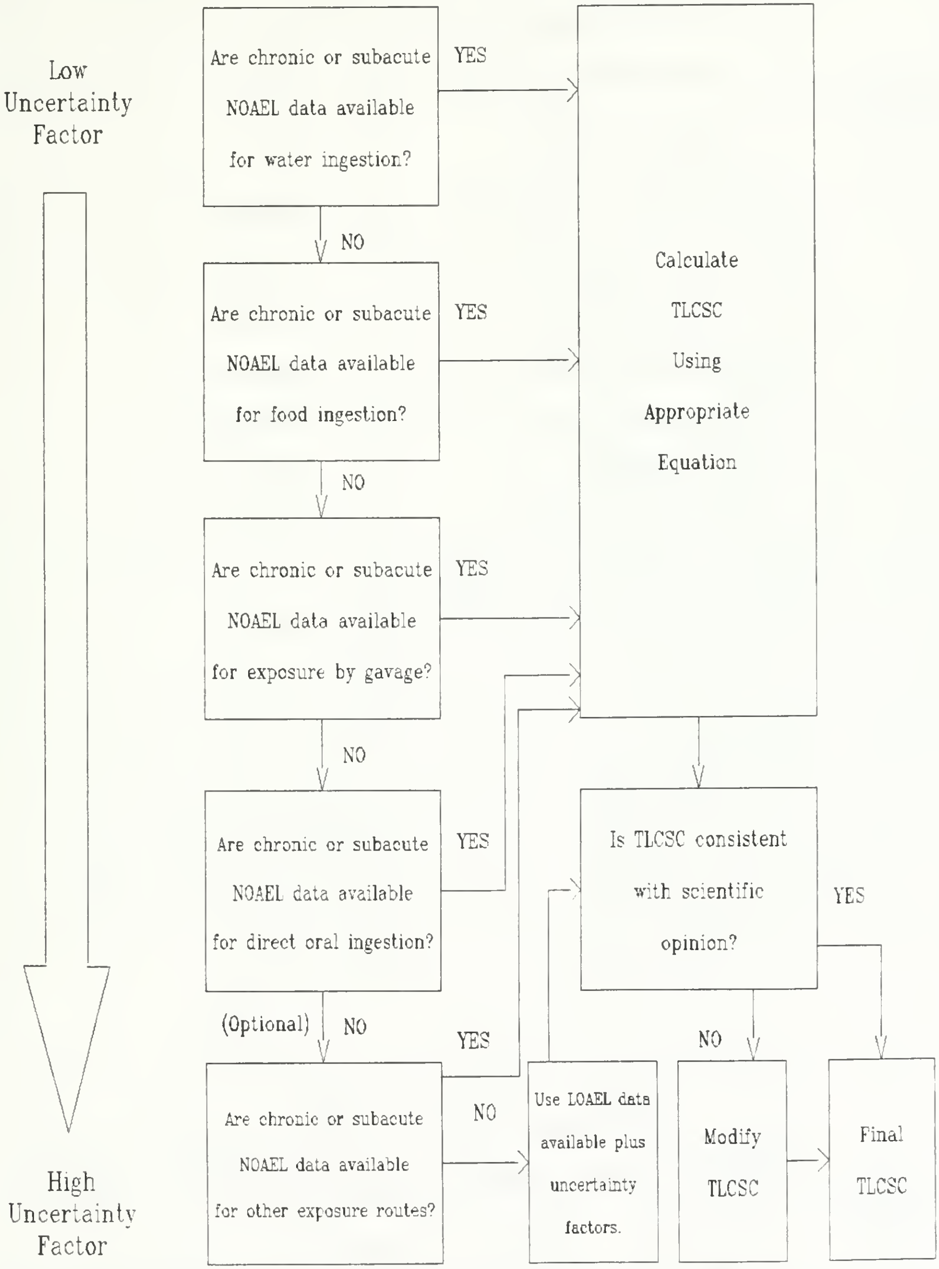

Low Uncertainty Factor
High Uncertainty Factor
Are chronic or subacute NOAEL data available for water ingestion?
YES
NO
Are chronic or subacute NOAEL data available for food ingestion?
YES
NO
Are chronic or subacute NOAEL data available for exposure by gavage?
YES
NO
Are chronic or subacute NOAEL data available for direct oral ingestion?
YES
(Optional)
NO
Are chronic or subacute NOAEL data available for other exposure routes?
YES
NO
Calculate TLCSC Using Appropriate Equation
Is TLCSC consistent with scientific opinion?
YES
NO
Use LOAEL data available plus uncertainty factors.
Modify TLCSC
Final TLCSC

Fig. B.3 Schematic Decision Tree of Calculational Procedure Used to Derive A Human Life Cycle Safe Concentration (HLCSC)

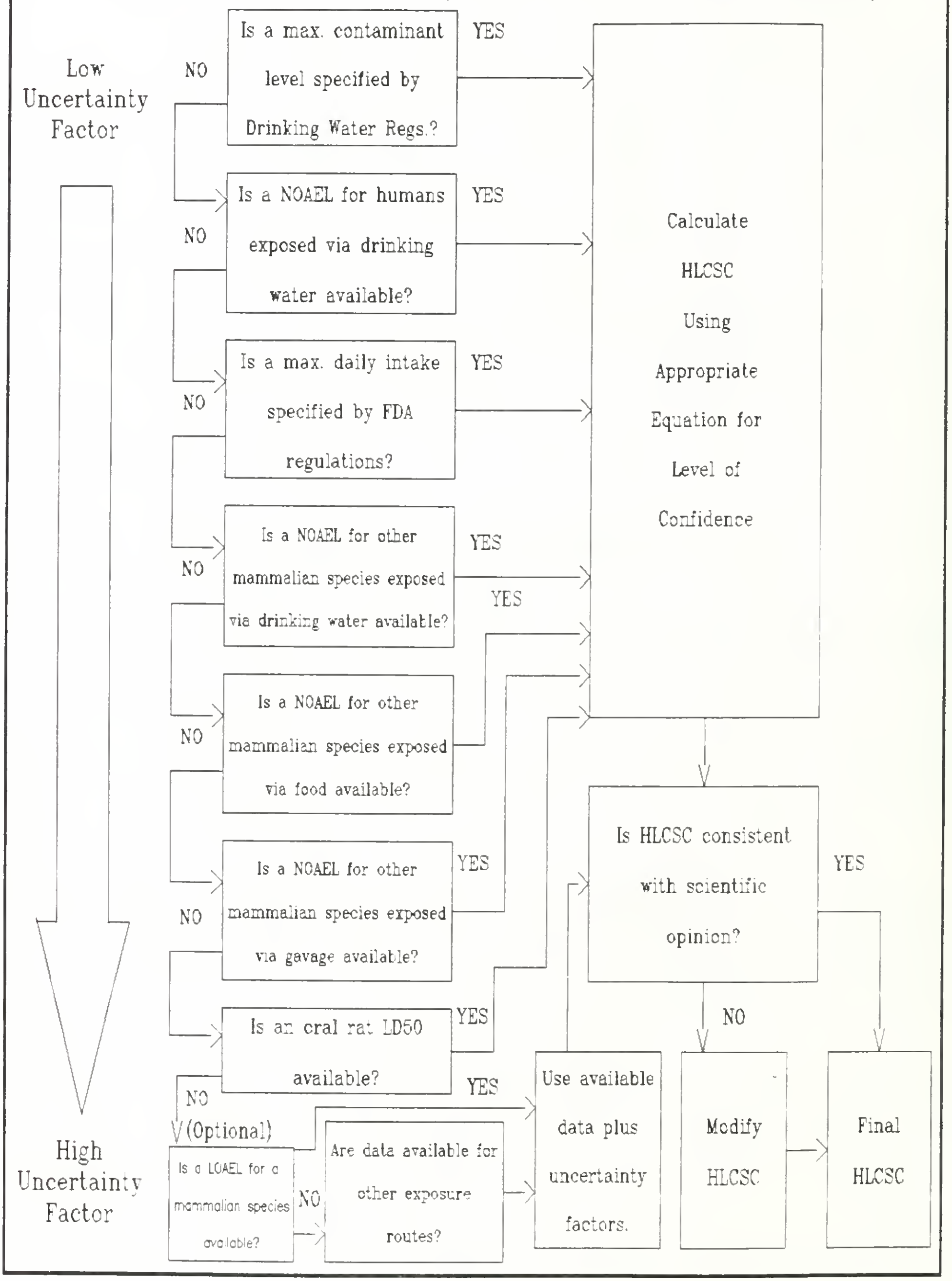
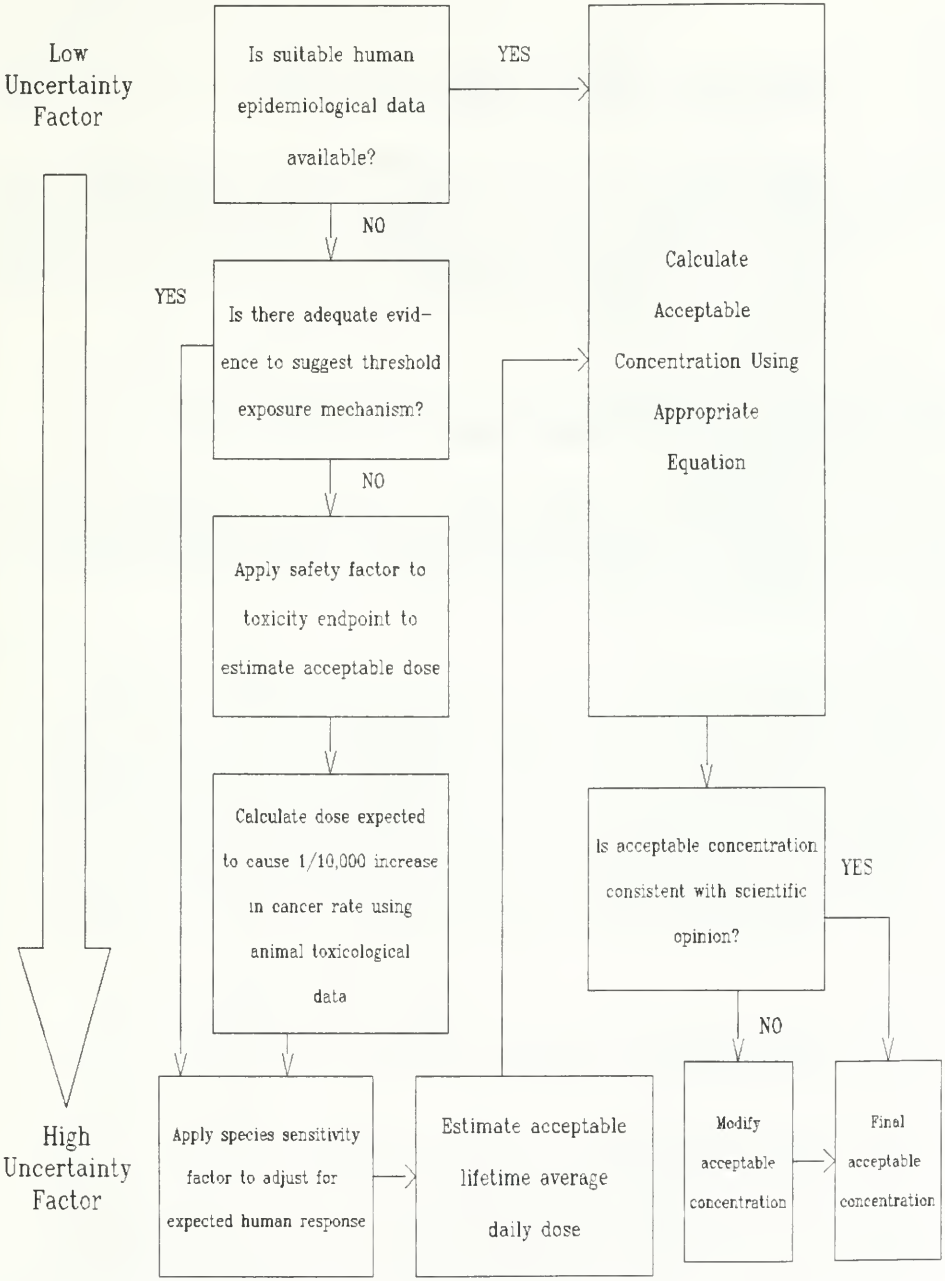

Low Uncertainty Factor
High Uncertainty Factor
Is a max. contaminant level specified by Drinking Water Regs.?
Is a NOAEL for humans exposed via drinking water available?
Is a max. daily intake specified by FDA regulations?
Is a NOAEL for other mammalian species exposed via drinking water available?
Is a NOAEL for other mammalian species exposed via food available?
Is a NOAEL for other mammalian species exposed via gavage available?
Is an oral rat LD50 available?
(Optional)
Is a LOAEL for a mammalian species available?
Are data available for other exposure routes?
YES
NO
Calculate HLCSC Using Appropriate Equation for Level of Confidence
Is HLCSC consistent with scientific opinion?
Use available data plus uncertainty factors.
Modify HLCSC
Final HLCSC

Fig. B.4 Schematic Decision Tree of Calculational Procedure Used to Derive Acceptable Concentration for Human Cancer Effects


Low Uncertainty Factor
High Uncertainty Factor
Is suitable human epidemiological data available?
YES
NO
Calculate Acceptable Concentration Using Appropriate Equation
Is there adequate evid-ence to suggest threshold exposure mechanism?
YES
NO
Apply safety factor to toxicity endpoint to estimate acceptable dose
Calculate dose expected to cause 1/10,000 increase in cancer rate using animal toxicological data
Is acceptable concentration consistent with scientific opinion?
YES
NO
Apply species sensitivity factor to adjust for expected human response
Estimate acceptable lifetime average daily dose
Modify acceptable concentration
Final acceptable concentration

B.2.5 Mutagenic and Genotoxic Effects Acceptable levels for contaminants exhibiting these effects are decided solely on the basis of expert opinion. No formal standard setting decision system is used.

B.2.6 Bioconcentration In both the human life cycle safe concentration procedure and that for human cancer effects, a bioconcentration factor (BCF) is applied to account for persistent and cumulative characteristics of some chemicals. A series of methods for deriving BCFs is presented that is analogous, at least in concept, to the standard setting procedures. Alternative types of data are discussed and procedures for deriving a BCF are set out. No minimum data requirement is defined.

B.3 Michigan Rule 57, Guidelines, Supporting Documentation and Associated Rules

The following is a copy of material supplied to the Ontario Ministry of the Environment by Mr. Jim Grant of the Michigan Department of Natural Resources. The preceding discussion is structured in a similar order to the following guidelines and should be cross-referenced to assist in interpretation.

DEPARTMENT OF NATURAL RESOURCES

WATER RESOURCES COMMISSION

GENERAL RULES

Filed with the Secretary of State on November 14, 1986
These rules take effect 15 days after filing with the Secretary of State

(By authority conferred on the water resources commission by sections 2 and 5 of Act No. 245 of the Public Acts of 1929, as amended, being §§323.2 and 323.5 of the Michigan Compiled Laws)

R 323.1041 to R 323.1050, R 323.1053, R 323.1055, R 323.1058 to R 323.1065, R 323.1070, R 323.1075, R 323.1082, R 323.1092 to R 323.1098, R 323.1100, and R 323.1116 of the Michigan Administrative Code, appearing on pages 1630 and 1632 to 1639 of the 1979 Administrative Code and pages 162 to 164, 166, and 167 of the 1984 Annual Supplement to the Code, are amended, and R 323.1099 is added, to read as hereinafter set forth.

R 323.1074, R 323.1080, R 323.1091, R 323.1110, and R 323.1115 of the Michigan Administrative Code, appearing on pages 1636 to 1644 of the 1979 Michigan Administrative Code, are rescinded.

PART 4. WATER QUALITY STANDARDS

R 323.1041 Purpose.

Rule 41. The purpose of the water quality standards as prescribed by these rules is to establish water quality requirements applicable to the Great Lakes, the connecting waters, and all other surface waters of the state, to protect the public health and welfare, to enhance and maintain the quality of water, to protect the state's natural resources, and serve the purposes of Public Law 92-500, as amended, 33 U.S.C. §466 et seq., Act No. 245 of the Public Acts of 1929, as amended, being §323.1 et seq. of the Michigan Compiled Laws, and the Great Lakes water quality agreement enacted November 22, 1978. These standards may not reflect current water quality in all cases, but are minimum water quality requirements for which the waters of the state are to be managed.

R 323.1043 Definitions; A to N.

Rule 43. As used in this part:

(a) "Agricultural use" means a use of water for agricultural purposes, including livestock watering, irrigation, and crop spraying.

(b) "Anadromous salmonids" means those trout and salmon which ascend streams to spawn.

(c) "Carcinogen" means a substance which causes an increased incidence of benign or malignant neoplasms or a substantial decrease in the latency period between exposure and onset of neoplasms through oral or dermal exposure or through inhalation exposure when the cancer occurs at nonrespiratory sites, in at least 1 mammalian species, or man through epidemiological or clinical studies, unless the commission, on the basis of credible scientific evidence, determines that there is significant uncertainty regarding the credibility, validity, or significance of such study or studies, in which case it shall refer the question of carcinogenicity to experts on carcinogenesis and shall consider the recommendations of those experts in making its final determination.

(d) "Coldwater fish" means those fish species whose populations thrive in relatively cold water, including trout, salmon, whitefish, and cisco.

(e) "Commission" means the Michigan water resources commission established pursuant to Act No. 245 of the Public Acts of 1929, as amended, being §323.1 et seq. of the Michigan Compiled Laws.

(f) "Connecting waters" means any of the following:

(i) The St. Marys river.
(ii) The Keweenaw waterway.
(iii) The Detroit river.
(iv) The St. Clair river.
(v) Lake St. Clair.

(g) "Designated use" means a use of the waters of the state as established by these rules, including use for any of the following:

(i) Industrial, agricultural, and public water supply.
(ii) Recreation.
(iii) Fish, other aquatic life, and wildlife.
(iv) Navigation.

(h) "Dissolved oxygen" means the amount of oxygen dissolved in water and is commonly expressed as a concentration in terms of milligrams per liter.

(i) "Dissolved solids" means the amount of materials dissolved in water and is commonly expressed as a concentration in terms of milligrams per liter.

(j) "Effluent" means a wastewater discharged from a point source to the waters of the state.

(k) "Fecal coliform" means a type of coliform bacteria found in the intestinal tract of humans and other warm-blooded animals.

(l) "Final acute value" means the level of a chemical or mixture of chemicals that does not allow the mortality of important fish or fish food organisms to exceed 50% when exposed for 96 hours, except where a shorter time period is appropriate for certain species.

(m) "Fish, other aquatic life, and wildlife use" means the use of the waters of the state by fish, other aquatic life, and wildlife for any life history stage or activity.

(n) "Industrial water supply" means a water source intended for use in commercial or industrial applications or for noncontact food processing.

(o) "Inland lake" means an inland body of standing water of the state situated in a topographic depression other than an artificial agricultural pond less than one acre, unless it is otherwise determined by the commission. The commission may designate a dammed river channel or an impoundment as an inland lake based on aquatic resources to be protected.

(p) "Keweenaw waterway" means the entire Keweenaw waterway, including Portage lake, Houghton county.

(q) "MATC" means the maximum acceptable toxicant concentration obtained by calculating the geometric mean of the lower and upper chronic limits from a chronic test. A lower chronic limit is the highest tested concentration which did not cause the occurrence of a specified adverse effect. An upper chronic limit is the lowest tested concentration which did cause the occurrence of a specified adverse effect and above which all tested concentrations caused such an occurrence.

(r) "Mixing zone" means that portion of a water body wherein a point source discharge is mixed with the receiving water.

(s) "Natural water temperature" means the temperature of a body of water without an influence from an artificial source or a temperature as otherwise determined by the commission.

(t) "NOAEL" means the highest level of toxicant which results in no observable adverse effects to exposed test organisms.

(u) "Non-point source" means a source of material other than a source defined as a point source.

R 323.1044 Definitions; P to W.

Rule 44. As used in this part:

(a) "Palatable" means the state of being agreeable or acceptable to the sense of sight, taste, or smell.

(b) "Plant nutrients" means those chemicals, including nitrogen and phosphorus, necessary for the growth and reproduction of aquatic rooted, attached, and floating plants, fungi, or bacteria.

(c) "Point source" means a discernible, confined, and discrete conveyance from which wastewater is or may be discharged to the waters of the state, including the following:

(i) A pipe.
(ii) A ditch.
(iii) A channel.
(iv) A tunnel.
(v) A conduit.
(vi) A well.
(vii) A discrete fissure.
(viii) A container.
(ix) A concentrated animal feeding operation.
(x) A boat or other watercraft.

(d) "Public water supply sources" means a surface raw water source which, after conventional treatment, provides a source of safe water for various uses, including human consumption, food processing, cooking, and as a liquid ingredient in foods and beverages.

(e) "Raw water" means the waters of the state before any treatment.

(f) "Receiving waters" means the waters of the state into which an effluent is or may be discharged.

(g) "Sanitary sewage" means treated or untreated wastewaters which contain human metabolic and domestic wastes.

(h) "Standard" means a definite numerical value or narrative statement promulgated by the commission to maintain or restore water quality to provide for, and fully protect, a designated use of the waters of the state.

(i) "Suspended solids" means the amount of materials suspended in water and is commonly expressed as a concentration in terms of milligrams per liter.

(j) "Total body contact recreation" means any activity where the human body may come into direct contact with water to the point of complete submergence, including swimming, waterskiing, and skin diving.

(k) "Toxic substance" means a substance, except heat, when present in sufficient concentrations or quantities which are or may become harmful to plant life, animal life, or designated uses.

(l) "Warmwater fish" means those fish species whose populations thrive in relatively warm water, including any of the following:

(i) Bass.
(ii) Pike.
(iii) Walleye.
(iv) Panfish.

(m) "Wastewater" means storm water runoff which could result in injury to a use designated in R 323.1100; liquid waste resulting from commercial, institutional, domestic, industrial, and agricultural activities, including cooling and condensing waters; sanitary sewage; and industrial waste.

(n) "Waters of the state" means all of the following, but does not include drainage ways and ponds used solely for wastewater conveyance, treatment, or control:

(i) The Great Lakes and their connecting waters.
(ii) All inland lakes.
(iii) Rivers.
(iv) Streams.
(v) Impoundments.
(vi) Open drains.
(vii) Other surface waterbodies within the confines of the state.

R 323.1050 Physical characteristics.

Rule 50. The waters of the state shall not have any of the following unnatural physical properties in quantities which are or may become injurious to any designated use:

(a) Turbidity.
(b) Color.
(c) Oil films.
(d) Floating solids.
(e) Foams.
(f) Settleable solids.
(g) Suspended solids.
(h) Deposits.

R 323.1051 Dissolved solids.

Rule 51. (1) The addition of any dissolved solids shall not exceed concentrations which are or may become injurious to any designated use. Point sources containing dissolved solids shall be considered by the commission on a case-by-case basis and increases of dissolved solids in the waters of the state shall be limited through the application of best practicable control technology currently available as prescribed by the administrator of the United States environmental protection agency pursuant to section 304(b) of Public Law 92-500, as amended, 33 U.S.C. §466 et seq., except that in no instance shall total dissolved solids in the waters of the state exceed a concentration of 500 milligrams per liter as a monthly average nor more than 750 milligrams per liter at any time, as a result of controllable point sources.

(2) The waters of the state designated as a public water supply source shall not exceed 125 milligrams per liter of chlorides as a monthly average, except for the Great Lakes and connecting waters, where chlorides shall not exceed 50 milligrams per liter as a monthly average.

R 323.1053 Hydrogen ion concentration.

Rule 53. The hydrogen ion concentration expressed as pH shall be maintained within the range of 6.5 to 9.0 in all waters of the state. Any artificially induced variation in the natural pH shall remain within this range and shall not exceed 0.5 units of pH.

R 323.1055 Taste- or odor-producing substances.

Rule 55. The waters of the state shall contain no taste-producing or odor-producing substances in concentrations which impair or may impair their use for a public, industrial, or agricultural water supply source which impair the palatability of fish as measured by test procedures approved by the commission.

R 323.1057. Toxic substances.

Rule 57. (1) Toxic substances shall not be present in the waters of the state at levels which are or may become injurious to the public health, safety, or welfare; plant and animal life; or the designated uses of those waters. Allowable levels of toxic substances shall be determined by the commission using appropriate scientific data.

(2) All of the following provisions apply for purposes of developing allowable levels of toxic substances in the surface waters of the state applicable to point source discharge permits issued pursuant to Act No. 245 of the Public Acts of 1929, as amended, being §323.1 et seq. of the Michigan Compiled Laws:

(a) Water quality-based effluent limits developed pursuant to this subrule shall be used only when they are more restrictive than technology-based limitations required pursuant to R 323.2137 and R 323.2140.

(b) The toxic substances to which this subrule shall apply are those on the 1984 Michigan critical materials register established pursuant to Act No. 245 of the Public Acts of 1929, as amended, being §323.1 et seq. of the Michigan Compiled Laws; the priority pollutants and hazardous chemicals in 40 C.F.R. §122.21, appendix D (1983); and any other toxic substances as the commission may determine are of concern at a specific site.

(c) Allowable levels of toxic substances in the surface water after a discharge is mixed with the receiving stream volume specified in R 323.1082 shall be determined by applying an adequate margin of safety to the MATC, NOAEL, or other appropriate effect end points, based on knowledge of the behavior of the toxic substance, characteristics of the receiving water, and the organisms to be protected.

(d) In addition to restrictions pursuant to subdivision (c) of this subrule, a discharge of carcinogens, not determined to cause cancer by a threshold mechanism, shall not create a level of risk to the public health greater than 1 in 100,000 in the surface water after mixing with the allowable receiving stream volume specified in R 323.1082. The commission may require a greater degree of protection pursuant to R 323.1098 where achievable through utilization of control measures already in place or where otherwise determined necessary.

(e) Guidelines shall be adopted pursuant to Act No. 306 of the Public Acts of 1969, as amended, being §24.201 et seq. of the Michigan Compiled Laws, setting forth procedures to be used by staff in the development of recommendations to the commission on allowable levels of toxic substances and the minimum data necessary to derive such recommendations. The commission may require the applicant to provide the minimum data when otherwise not available for derivation of allowable levels of toxic substances.

(f) For existing discharges, the commission may issue a scheduled abatement permit pursuant to R 323.2145 upon a determination by the commission that the applicant has demonstrated that each of the following conditions is met:

(i) Immediate attainment of the allowable level of a toxic substance is not economically or technically feasible.

(ii) No prudent alternative exists.

(iii) During the period of scheduled abatement, the permitted discharge will be consistent with the protection of the public health, safety, and welfare.

(iv) Reasonable progress will be made toward compliance with this rule over the term of the permit, as provided for in a schedule in the permit.

R 323.1058 Radioactive substances.

Rule 58. The control and regulation of radioactive substances discharged to the waters of the state shall be pursuant to the criteria, standards, or requirements prescribed by the United States nuclear regulatory commission in 10 C.F.R. §20.1 et seq. and by the United States environmental protection agency.

R 323.1060 Plant nutrients.

Rule 60. (1) Consistent with Great Lakes protection, phosphorus which is or may readily become available as a plant nutrient shall be controlled from point source discharges to achieve 1 milligram per liter of total phosphorus as a maximum monthly average effluent concentration unless other limits, either higher or lower, are deemed necessary and appropriate by the commission.

(2) In addition to the protection provided under subrule (1) of this rule, nutrients shall be limited to the extent necessary to prevent stimulation of growths of aquatic rooted, attached, suspended, and floating plants, fungi or bacteria which are or may become injurious to the designated uses of the waters of the state.

R 323.1062 Microorganisms.

Rule 62. (1) All waters of the state shall contain not more than 200 fecal coliform per 100 milliliters. This concentration may be exceeded if such concentration is due to uncontrollable non-point sources. The commission may suspend this rule from November 1 through April 30 upon determining that designated uses will be protected.

(2) Compliance with the fecal coliform standards prescribed by subrule (1) of this rule shall be determined on the basis of the geometric average of any series of 5 or more consecutive samples taken over not more than a 30-day period.

(3) Protection of the waters of the state designated for total body contact recreation and public water supply source by the water quality standards prescribed by this rule may be subject to temporary interruption during or following flood conditions, accidents, or emergencies which affect a sewer or wastewater treatment system. In the event of such occurrences, notice shall be served to those affected in accordance with procedures established by the commission. Prompt corrective action shall be taken by the discharger to restore the designated use.

R 323.1064 Dissolved oxygen in Great Lakes, connecting waters, and inland streams.

Rule 64. (1) A minimum of 7 milligrams per liter of dissolved oxygen in all Great Lakes and connecting waterways shall be maintained, and, except for inland lakes as prescribed in R 323.1065, a minimum of 7 milligrams per liter of dissolved oxygen shall be maintained at all times in all inland waters designated by these rules to be protected for coldwater fish. In all other waters, except for inland lakes as prescribed by R 323.1065, a minimum of 5 milligrams per liter of dissolved oxygen shall be maintained. These standards do not apply for a limited warmwater fishery use subcategory or limited coldwater fishery use subcategory established pursuant to R 323.1100(10) or during those periods when the standards specified in subrule (2) of this rule apply.

(2) Waters of the state which do not meet the standards set forth in subrule (1) of this rule shall be upgraded to meet those standards. For existing point source discharges to these waters, the commission may issue permits pursuant to R 323.2145 which establish schedules to achieve the standards set forth in subrule (1) of this rule. If existing point source dischargers demonstrate to the commission that the dissolved oxygen standards specified in subrule (1) of this rule are not attainable through further feasible and prudent reductions in their discharges or that the diurnal variation between the daily average and daily minimum dissolved oxygen concentrations in those waters exceeds 1 milligram per liter, further reductions in oxygen-consuming substances from such discharges will not be required, except as necessary to meet the interim standards specified in this subrule, until comprehensive plans to upgrade these waters to the standards specified in subrule (1) of this rule have been approved by the commission and orders, permits, or other actions necessary to implement the approved plans have been issued by the commission. In the interim, all of the following standards apply:

(a) For waters of the state designated for use for coldwater fish, except for inland lakes as prescribed in R 323.1065, the dissolved oxygen shall not be lowered below a minimum of 6 milligrams per liter at the design flow during the warm weather season in accordance with R 323.1090(3) and (4). At the design flows during other seasonal periods, as provided in R 323.1090(4), a minimum of 7 milligrams per liter shall be maintained. At flows greater than the design flows, dissolved oxygen shall be higher than the respective minimum values specified in this subdivision.

(b) For waters of the state designated for use for warmwater fish and other aquatic life, except for inland lakes as prescribed in R 323.1065, the dissolved oxygen shall not be lowered below a minimum of 4 milligrams per liter, or below 5 milligrams per liter as a daily average, at the design flow during the warm weather season in accordance with R 323.1090(3) and (4). At the design flows during other seasonal periods as provided in R 323.1090(4), a minimum of 5 milligrams per liter shall be maintained. At flows greater than the design flows, dissolved oxygen shall be higher than the respective minimum values specified in this subdivision.

(c) For waters of the state designated for use for warmwater fish and other aquatic life, but also designated as principal migratory routes for anadromous salmonids, except for inland lakes as prescribed in R 323.1065, the dissolved oxygen shall not be lowered below 5 milligrams per liter as a minimum during periods of migration.

(3) The commission may cause a comprehensive plan to be prepared to upgrade waters to the standards specified in subrule (1) of this rule taking into consideration all factors affecting dissolved oxygen in these waters and the cost effectiveness of control measures to upgrade these waters and, after notice and hearing, approve the plan. After notice and hearing, the commission may amend a comprehensive plan for cause. In undertaking the comprehensive planning effort the commission shall provide for and encourage participation by interested and impacted persons in the affected area. Persons directly or indirectly discharging substances which contribute towards these waters not meeting the standards specified in subrule (1) of this rule may be required after notice and order to provide necessary information to assist in the development or amendment of the comprehensive plan. Upon notice and order, permit, or other action of the commission, persons directly or indirectly discharging substances which contribute toward these waters not meeting the standards specified in subrule (1) of this rule shall take the necessary actions consistent with the approved comprehensive plan to control these discharges to upgrade these waters to the standards specified in subrule (1) of this rule.

R 323.1065 Dissolved oxygen; inland lakes.

Rule 65. (1) The following standards for dissolved oxygen shall apply to lakes designated as trout lakes by the natural resources commission or lakes listed in the publication entitled "Coldwater Lakes of Michigan":

(a) In stratified coldwater lakes which have dissolved oxygen concentrations less than 7 milligrams per liter in the upper half of the hypolimnion, a minimum of 7 milligrams per liter dissolved oxygen shall be maintained throughout the epilimnion and upper 1/3 of the thermocline during stratification. Lakes capable of sustaining oxygen throughout the hypolimnion shall maintain oxygen throughout the hypolimnion. At all other times, dissolved oxygen concentrations greater than 7 milligrams per liter shall be maintained.

(b) Except for lakes described in subdivision (c) of this subrule, in stratified coldwater lakes which have dissolved oxygen concentrations greater than 7 milligrams per liter in the upper half of the hypolimnion, a minimum of 7 milligrams per liter of dissolved oxygen shall be maintained in the epilimnion, thermocline, and upper half of the hypolimnion. Lakes capable of sustaining oxygen throughout the hypolimnion shall maintain oxygen throughout the hypolimnion. At all other times, dissolved oxygen concentrations greater than 7 milligrams per liter shall be maintained.

(c) In stratified coldwater lakes which have dissolved oxygen concentrations greater than 7 milligrams per liter throughout the hypolimnion, a minimum of 7 milligrams per liter shall be maintained throughout the lake.

(d) In unstratified coldwater lakes, a minimum of 7 milligrams per liter of dissolved oxygen shall be maintained throughout the lake.

(2) For all other inland lakes not specified in subrule (1) of this rule, during stratification, a minimum dissolved oxygen concentration of 5 milligrams per liter shall be maintained throughout the epilimnion. At all other times, dissolved oxygen concentrations greater than 5 milligrams per liter shall be maintained.

R 323.1069. Temperature; general considerations.

Rule 69. (1) In all waters of the state, the points of temperature measurement normally shall be in the surface 1 meter; however, where turbulence, sinking plumes, discharge inertia or other phenomena upset the natural thermal distribution patterns of receiving waters, temperature measurements shall be required to identify the spatial characteristics of the thermal profile.

(2) Monthly maximum temperatures, based on the ninetieth percentile occurrence of natural water temperatures plus the increase allowed at the edge of the mixing zone and in part on long-term physiological needs of fish, may be exceeded for short periods when natural water temperatures exceed the ninetieth percentile occurrence. Temperature increases during these periods may be permitted by the commission, but in all cases shall not be greater than the natural water temperature plus the increase allowed at the edge of the mixing zone.

(3) Natural daily and seasonal temperature fluctuations of the receiving waters shall be preserved.

R 323.1070 Temperature of Great Lakes and connecting waters.

Rule 70. (1) The Great Lakes and connecting waters shall not receive a heat load which would warm the receiving water at the edge of the mixing zone more than 3 degrees Fahrenheit above the existing natural water temperature.

(2) The Great Lakes and connecting waters shall not receive a heat load which would warm the receiving water at the edge of the mixing zone to temperatures in degrees Fahrenheit higher than the following monthly maximum temperature:

(a) Lake Michigan north of a line due west from the city of Pentwater.

J	F	M	A	M	J	J	A	S	O	N	D
40	40	40	50	55	70	75	75	75	65	60	45

(b) Lake Michigan south of a line due west from the city of Pentwater.

J	F	M	A	M	J	J	A	S	O	N	D
45	45	45	55	60	70	80	80	80	65	60	50

(c) Lake Superior and the St. Marys river:

J	F	M	A	M	J	J	A	S	O	N	D
38	36	39	46	53	61	71	74	71	61	49	42

(d) Lake Huron north of a line due east from Tawas point:

J	F	M	A	M	J	J	A	S	O	N	D
40	40	40	50	60	70	75	80	75	65	55	45

(e) Lake Huron south of a line due east from Tawas point, except Saginaw bay.

J	F	M	A	M	J	J	A	S	O	N	D
40	40	40	55	60	75	80	80	80	65	55	45

(f) Lake Huron, Saginaw bay:

J	F	M	A	M	J	J	A	S	O	N	D
45	45	45	60	70	75	80	85	78	65	55	45

(g) St. Clair river:

J	F	M	A	M	J	J	A	S	O	N	D
40	40	40	50	60	70	75	80	75	65	55	50

(h) Lake St. Clair:

J	F	M	A	M	J	J	A	S	O	N	D
40	40	45	55	70	75	80	83	80	70	55	45

(i) Detroit river:

J	F	M	A	M	J	J	A	S	O	N	D
40	40	45	60	70	75	80	83	80	70	55	45

(j) Lake Erie:

J	F	M	A	M	J	J	A	S	O	N	D
45	45	45	60	70	75	80	85	80	70	60	50

R 323.1075 Temperature of rivers, streams, and impoundments.

Rule 75. (1) Rivers, streams, and impoundments naturally capable of supporting coldwater fish shall not receive a heat load which would do either of the following:

(a) Increase the temperature of the receiving waters at the edge of the mixing zone more than 2 degrees Fahrenheit above the existing natural water temperature.

(b) Increase the temperature of the receiving waters at the edge of the mixing zone to temperatures greater than the following monthly maximum temperatures:

J	F	M	A	M	J	J	A	S	O	N	D
38	38	43	54	65	68	68	68	63	56	48	40

(2) Rivers, streams, and impoundments naturally capable of supporting warmwater fish shall not receive a heat load which would warm the receiving water at the edge of the mixing zone more than 5 degrees Fahrenheit above the existing natural water temperature.

(3) Rivers, streams, and impoundments naturally capable of supporting warmwater fish shall not receive a heat load which would warm the receiving water at the edge of the mixing zone to temperatures greater than the following monthly maximum temperatures:

(a) For rivers, streams, and impoundments north of a line between Bay City, Midland, Alma and North Muskegon:

J	F	M	A	M	J	J	A	S	O	N	D
38	38	41	56	70	80	83	81	74	64	49	39

(b) For rivers, streams, and impoundments south of a line between Bay City, Midland, Alma, and North Muskegon, except the St. Joseph river:

J	F	M	A	M	J	J	A	S	O	N	D
41	40	50	63	76	84	85	85	79	68	55	43

(c) St. Joseph river:

J	F	M	A	M	J	J	A	S	O	N	D
50	50	55	65	75	85	85	85	85	70	60	50

(4) Non-trout rivers and streams that serve as principal migratory routes for anadromous salmonids shall not receive a heat load during periods of migration at such locations and in a manner which may adversely affect salmonid migration or raise the receiving water temperature at the edge of the mixing zone more than 5 degrees Fahrenheit above the existing natural water temperature.

R 323.1082 Mixing zones.

Rule 82. (1) A mixing zone to achieve a mixture of a point source discharge with the receiving waters shall be considered a region in which the response of organisms to water quality characteristics is time dependent. Exposure in mixing zones shall not cause an irreversible response which results in deleterious effects to populations of aquatic life or wildlife. As a minimum restriction, the final acute value for aquatic life shall not be exceeded in the mixing zone at any point inhabitable by these organisms, unless it can be demonstrated to the commission that a higher level is acceptable. The mixing zone shall not prevent the passage of fish or fish food organisms in a manner which would result in adverse impacts on their immediate or future populations. Watercourses or portions thereof which, without 1 or more point source discharge, would have no flow except during periods of surface runoff may be considered as a mixing zone for a point source discharge. The area of mixing zones should be minimized. To this end, devices for rapid mixing, dilution, and dispersion are encouraged where practicable.

(2) For toxic substances, not more than 25% of the receiving water design flow, as stated in R 323.1090, shall be utilized when determining effluent limitations for surface water discharges, unless it can be demonstrated to the commission that the use of a larger volume is acceptable. The commission shall not base a decision to grant more than 25% of the receiving water design flow for purposes of developing effluent limitations for discharges of toxic substances solely on the use of rapid mixing, dilution, or dispersion devices. However, where such a device is or may be employed, the commission may authorize the use of a design flow greater than 25% if the effluent limitations which correspond to such a design flow are shown, based upon a site-specific demonstration, to be consistent with Act No. 245 of the Public Acts of 1929, as amended, being §323.1 et seq. of the Michigan Compiled Laws, and other applicable law.

(3) For substances not included in subrule (2) of this rule, the design flow, as stated in R 323.1090, shall be utilized when determining effluent limitations for surface water discharges if the provisions in subrule (1) of this rule are met, unless the commission determines that a more restrictive volume is necessary.

(4) For all substances, defined mixing zone boundaries may be established and shall be determined on a case-by-case basis.

(5) Mixing zones in the Great Lakes, their connecting waters, and inland lakes shall be determined on a case-by-case basis.

R 323.1090. Applicability of water quality standards.

Rule 90. (1) The water quality standards prescribed by these rules shall not apply within mixing zones, except for those standards prescribed in R 323.1082(1) and R 323.1050.

(2) Water quality standards prescribed by these rules are minimally acceptable water quality conditions. Water quality shall be equal to or better than such minimal water quality conditions not less than 95% of the time.

(3) Water quality standards shall apply at all flows equal to or exceeding the design flow. The design flow is equal to the most restrictive of the 12 monthly 95% exceedance flows, except where the commission determines that a more restrictive design flow is necessary or where the commission determines that seasonal design flows may be granted pursuant to R 323.1090(4). The 95% exceedance flow is the flow equal to or exceeded 95% of the time for the specified month.

(4) A maximum of 4 seasonal design flows may be granted when determining effluent limitations for a surface water discharge if it is determined by the commission that the use of such design flows will protect water quality and be consistent with the protection of the public health, safety, and welfare. The seasonal design flows shall be the most restrictive of the monthly 95% exceedance flow for the months in each season. Seasonal design flows shall not be granted for toxic substances which, on the basis of credible scientific evidence, may bioaccumulate in biota inhabiting or using the waters of the state unless, taking into account the receiving water characteristics the persistence and environmental fate characteristics of the substance or substances and the presence of other discharges of bioaccumulative toxic substances into the same receiving waters, the commission determines that the increased mass loading of the substance or substances resulting from granting seasonal design flows is consistent with Act No. 245 of the Public Acts of 1929, as amended, being §323.1 et seq. of the Michigan Compiled Laws, and other applicable law.

R 323.1092 Applicability of water quality standards to dredging or construction activities.

Rule 92. Unless the commission determines, after consideration of dilution and dispersion, that such activities result in unacceptable adverse impacts on designated uses, the water quality standards prescribed by these rules shall not apply to dredging or construction activities within the waters of the state where such activities occur or during the periods of time when the aftereffects of dredging or construction activities degrade water quality within such waters of the state, if the dredging operations or construction activities have been authorized by the United States army corps of engineers or the department of natural resources. The water quality standards shall apply, however, in nonconfined waters of the state utilized for the disposal of spoil from dredging operations, except within spoil disposal sites specifically defined by the United States army corps of engineers or the department of natural resources.

R 323.1096 Determinations of compliance with water quality standards.

Rule 96. Analysis of the waters of the state to determine compliance with the water quality standards prescribed by these rules shall be made pursuant to procedures outlined in 40 C.F.R. §136, as amended by F.R. pp. 43234 to 43442 October 26, 1984, and F.R. pp. 690 to 697 January 4, 1985, or pursuant to other methods prescribed or approved by the commission and the United States environmental protection agency.

R 323.1097 Materials applications not subject to standards.

Rule 97. The application of materials for water resource management projects pursuant to state statutory provisions is not subject to the standards prescribed by these rules, but all projects shall be reviewed and approved by the commission before application.

R 323.1098 Antidegradation.

Rule 98. (1) This rule applies to waters of the state in which the existing water quality is better than the water quality standards prescribed by these rules or than needed to protect existing uses.

(2) These waters shall not be lowered in quality by action of the commission unless it is determined by the commission that such lowering will not do any of the following:

(a) Become injurious to the public health, safety, or welfare.

(b) Become injurious to domestic, commercial, industrial, agricultural, recreational, or other uses which are or may be made of such waters.

(c) Become injurious to the value or utility of riparian lands.

(d) Become injurious to livestock, wild animals, including birds, fish, and other aquatic animals, or plants, or their growth or propagation.

(e) Destroy or impair the value of game, fish, and wildlife.

(f) Be unreasonable and against the public interest in view of the existing conditions.

(3) All of the following waters are designated as protected waters:

(a) All Michigan waters of the Great Lakes, except as these waters may be affected by discharges to the connecting waters and tributaries.

(b) Trout streams south of a line between Bay City, Midland, Alma, and North Muskegon.

(c) Inland lakes.

(d) Reaches of country-scenic and wild-scenic rivers designated under Act No. 231 of the Public Acts of 1970, being §281.761 et seq. of the Michigan Compiled Laws.

(e) Scenic and recreational rivers designated under the wild and scenic rivers act of 1968, 16 U.S.C. §1721 et seq.

(4) In addition to the requirements of subrule (2) of this rule, the waters specified in subrule (3) of this rule shall not be lowered in quality unless, after opportunity for public hearing, it has been demonstrated by the applicant to the commission that a lowering in quality will not be unreasonable, is in the public interest in view of existing conditions, is necessary to accommodate important social or economic

development, and that there are no prudent and feasible alternatives to lowering water quality.

(5) Reaches of the following rivers have been designated pursuant to Act No. 231 of the Public Acts of 1970, being §281.761 et seq. of the Michigan Compiled Laws:

(a) Jordan river - October, 1972, natural river plan.
(b) Betsie river - July, 1973, natural river plan.
(c) Rogue river - July, 1973, natural river plan.
(d) White river - May, 1975, natural river plan.
(e) Boardman river - December, 1975, natural river plan.
(f) Huron river - May, 1977, natural river plan.
(g) Pere Marquette river - July, 1978, natural river plan
(h) Flat river - October, 1979, natural river plan.
(i) Rifle river - May, 1980, natural river plan.
(j) Kalamazoo river - June, 1981, natural river plan.
(k) Pigeon river - June, 1982, natural river plan.

Designated reaches of these rivers are provided in the department of natural resources natural river plan for each respective river.

(6) Reaches of the AuSable river - November, 1984, have been designated pursuant to the wild and scenic rivers act of 1968, 16 U.S.C. §1721 et seq.

(7) Michigan's waters of the Great Lakes are of special significance and are designated as outstanding state resource waters. In addition to the protection specified under subrules (2), (3) and (4) of this rule, mixing zones shall not be used for new or increased discharges to the Great Lakes of toxic substances, as defined by R 323.1057(2)(b), which would result in a lowering of water quality. However, the commission may grant a mixing zone for certain toxic substances on a case-by-case basis, taking into account credible scientific evidence, including persistence and environmental fate characteristics of the substances. Mixing zones for existing discharges of these toxic substances to the Great Lakes and for all discharges of these toxic substances to the connecting waters shall be minimized.

(8) Before authorizing a new or increased discharge of wastewater directly to the Great Lakes or connecting waters, the commission shall provide, in addition to the public notice required by commission rules, supplemental notice of its intent to authorize such discharge, of its proposed determination with respect to the applicable factors set forth in subrule (4) of this rule, and the proposed national pollutant discharge elimination system permit terms and conditions, to the administrator of the United States environmental protection agency, the director of the state or provincial water pollution control agency for all states or provinces which border the lake or connecting waters which receive the new or increased discharge, the United States fish and wildlife service, and the international joint commission. The commission shall allow not less than 30 days for comments from the recipients of the supplemental notice and shall carefully consider all comments received in making its determination.

(9) Wild rivers designated under the wild and scenic rivers act of 1968, 16 U.S.C. §1721 et seq., rivers flowing into, through, or out of national parks or national lakeshores, and wilderness rivers designated under Act No. 231 of the Public Acts of 1970, being §281.761 et seq. of the Michigan Compiled Laws, shall not be lowered in quality. Reaches of

the Two Hearted river - December, 1973, natural river plan - are designated under Act No. 231 of the Public Acts of 1970 as a wilderness river.

R 323.1099 Waters which do not meet standards.

Rule 99. Waters of the state which do not meet the water quality standards prescribed by these rules shall be improved to meet those standards. Where the water quality of certain waters of the state does not meet the water quality standards as a result of natural causes or conditions, further reduction of water quality is prohibited.

R 323.1100 Designated uses.

Rule 100. (1) As a minimum, all waters of the state are designated for, and shall be protected for, all of the following uses:

(a) Agriculture.
(b) Navigation.
(c) Industrial water supply.
(d) Public water supply at the point of water intake.
(e) Warmwater fish.
(f) Other indigenous aquatic life and wildlife.
(g) Partial body contact recreation.

(2) All waters of the state are designated for, and shall be protected for, total body contact recreation from May 1 to October 31 in accordance with R 323.1062. The commission will annually publish a list of those waters of the state located immediately downstream of municipal sewage system discharges where total or partial body contact recreation is contrary to prudent public health practices.

(3) All inland lakes identified in the publication entitled "Coldwater Lakes of Michigan," as published in 1976 by the department of natural resources, are designated for, and shall be protected for, coldwater fish.

(4) All Great Lakes and their connecting waters, except the entire Keweenaw waterway, including Portage lake, Houghton county, and Lake St. Clair, are designated for, and shall be protected for, coldwater fish.

(5) All lakes designated as trout lakes by the natural resources commission under the authority of Act No. 165 of the Public Acts of 1929, as amended, being §301.1 et seq. of the Michigan Compiled Laws, are designated for, and shall be protected for, coldwater fish.

(6) All waters of the state designated as trout streams by the director of the department pursuant to section 8 of Act No. 165 of the Public Acts of 1929, as amended, being §301.8 et seq. of the Michigan Compiled Laws, shall be protected for coldwater fish.

(7) All waters of the state which are designated by the Michigan department of public health as existing or proposed for use as public water supply sources are protected for such use at the point of water intake and in such contiguous areas as the commission may determine necessary for assured protection.

(8) Water quality of all waters of the state serving as migratory routes for anadromous salmonids shall be protected as necessary to assure that migration is not adversely affected.

(9) Discharges to wetlands, as defined by Act No. 203 of the Public Acts of 1979, being §281.701 of the Michigan Compiled Laws, that result in quality less than that prescribed by these rules may be permitted after a use attainability analysis shows that designated uses are not and cannot be attained and shows that attainable uses will be protected.

(10) After completion of a comprehensive plan developed pursuant to R 323.1064(3), upon petition by a municipality or other person, and in conformance with the requirements of 40 C.F.R. §131.10 (1983), the commission may determine that attainment of the dissolved oxygen standards of R 323.1064(1) is not feasible and designate, by amendment to this rule, a limited warmwater fishery use subcategory of the warmwater fishery use or a limited cold water fishery use subcategory of the cold water fishery use. For waters so designated, the dissolved oxygen standards specified in R 323.1064(2) and all other applicable standards of these rules apply. For waters so designated, the dissolved oxygen standards specified in R 323.1064(1) do not apply. Not less than sixty days before filing a petition under this subrule by a municipality or other person, a petitioner shall provide written notice to the executive secretary of the water resources commission and the clerk of the municipalities in which the affected waters are located of its intent to file such petition.

R 323.1105. Multiple designated uses.

Rule 105. When a particular portion of the waters of the state is designated for more than 1 use, the most restrictive water quality standards for one or more of those designated uses shall apply to that portion.

R 323.1116 Availability of documents.

Rule 116. Documents referenced in R 323.1057, R 323.1058, R 323.1065, R 323.1096, and R 323.1100 may be obtained at current costs as follows:

(a) "EPA Priority Pollutants and Hazardous Substances," 40 C.F.R. §122.21, appendix D (1983); copies may be obtained from the Department of Natural Resources, P.O. Box 30028, Lansing, Michigan 48909, at no cost, or from the Office of Water Enforcement, United States Environmental Protection Agency, Washington, D.C. 20460, at no cost.

(b) "1984 Michigan Critical Materials Register;" copies may be obtained from the Department of Natural Resources, P.O. Box 30028, Lansing, Michigan 48909, at no cost.

(c) "Guidelines Establishing Test Procedures for Analysis of Pollutants," 40 C.F.R. §136 as amended by F.R. pp 43234 to 43442, October 26, 1984, and F.R. pp. 690 to 697, January 4, 1985; copies may be obtained from the Department of Natural Resources, P.O. Box 30028, Lansing, Michigan 48909, at no cost.

(d) "Designated Trout Lakes," a publication of the department of natural resources; copies may be obtained from the Department of Natural Resources, P.O. Box 30028, Lansing, Michigan 48909, at no cost.

(e) "Coldwater Lakes of Michigan," August, 1976, a publication of the department of natural resources, fisheries division, copies may be obtained from the Department of Natural Resources, P.O. Box 30028, Lansing, Michigan 48909, at no cost.

(f) "Designated Trout Streams for the State of Michigan," April, 1975, a publication of the department of natural resources; copies may be obtained from the Department of Natural Resources, P.O. Box 30028, Lansing, Michigan 48909, at no cost.

(g) "Standards for Protection Against Radiation," 10 C.F.R. §20, January 1, 1985. Copies may be obtained from the Department of Natural Resources, P.O. Box 30028, Lansing, Michigan 48909, at no cost.

(h) "Designation of uses," 40 C.F.R. §131.10, as published in November 8, 1983 F.R. pp. 51406 and 51407; copies may be obtained from the Department of Natural Resources, P.O. Box 30028, Lansing, Michigan 48909, at no cost.

APPENDIX C

SYSTEMS AND TECHNOLOGIES EVALUATION

This appendix elaborates on the evaluations presented in Chapters 4 and 6 regarding the setting of water quality standards and effluent limits respectively. The evaluation criteria set out in Chapter 2 are used to systematically structure the evaluation. The two US systems evaluated are described in Appendices A and B preceding.

C.1 Water Quality Standards

Three alternative systems are evaluated; they are:

i) Current Ontario Procedure
ii) Michigan Rule 57
iii) US EPA Total Toxicity Standards

C.1.1 Comprehensiveness There are two types of comprehensiveness: one is with respect to contaminant types and the other relates to impact type. These are considered separately in the following discussion.

C.1.1.1 Contaminants Both the Ontario and Michigan systems are chemical-specific; as a result, they are not comprehensive with respect to all contaminant types. For example, there are standards in Michigan for nearly 200 contaminants, yet, the known number of chemicals is several orders of magnitude greater than this. Clearly, there are a large number of potential toxics without standards and for which little or nothing is known of their effects. Furthermore, it is unlikely that standards will be practically formulated within the foreseeable future for all compounds currently being released to the environment.

The US EPA system consists of both chemical-specific and toxicity standards. Only the latter standards are considered in this evaluation. A primary advantage of toxicity standards is that they are not chemical specific and capture interactive effects among contaminants in complex effluents. Toxicity is a generic characteristic and is not chemical-specific; as a result, these standards are practically applicable to any contaminant or combination thereof. Clearly, toxicity standards are superior to chemical-specific standards with respect to this criteria.

C.1.1.2 Impacts The Michigan system recognises six impact types, three of which pertain to human health. Of the six impact types considered, toxicity limits are able to directly deal with only two, namely, acute and chronic aquatic ecosystem effects. The current Ontario system directly deals with aquatic ecosystem effects and, to a lesser extent, terrestrial ecosystem effects. Human health effects are dealt with either indirectly (eg. via fish consumption limits) or are based on values derived by other agencies (eg. Health and Welfare Canada).

The Ontario system could be readily expanded to include more comprehensive consideration of human health effects; the barriers are not technical but rather ones of jurisdiction and mandate. On the other hand, expansion of the toxicity limits to include human health effects is constrained by the lack of reliable generic tests comparable to those for acute and chronic toxicity. The unavailability of reliable generic tests for these other impact types is a primary reason for retaining chemical-specific standards. The Michigan system is more comprehensive and explicit than the Ontario system, particularly with respect to human health impacts.

C.1.2 Flexibility Flexibility consists of the ability to easily incorporate new information and to be applicable to a wide range of conditions. Each are considered separately.

C.1.2.1 New Information A major advantage of the Michigan system over that used in Ontario is its ability to readily incorporate new information as it comes available and even to encourage dischargers to obtain more extensive and reliable information to support a given standard. The Michigan system sets out an explicit procedure whereby data are used to derive standards and uncertainty factors are applied based on the nature of the available data. As new results become available, they can be efficiently introduced to the standard setting derivation process without the need for an extensive interpretive procedure. As a result, the explicit structure of the Michigan system permits it to be more flexible in dealing with new information. In addition, the effect of new data on the resultant standards can be reasonably predicted. This reduces the need for extensive public consultation each time the standards are modified. Once agreement on the procedure is reached the updating process is relatively straightforward.

The toxicity standard system is not sensitive to new information. The derivation of toxicity standards is not a technical exercise: instead, it involves reaching a public policy decision regarding an acceptable level of environmental quality. Accordingly, this approach is more flexible and much less sensitive than chemical-specific approaches in terms of new information.

C.1.2.2 Environmental Setting The chemical and physical characteristics of the receiving environment can significantly influence the net effect of contaminants. For example, metal toxicity is usually greater in soft water. These types of relationships are explicitly dealt with in the Michigan system and less so in the Ontario approach. In both cases, however, the actual standard is set uniformly without consideration of the characteristics of the receiving waterbody. With these systems, standards could be set as function of significant water quality characteristics but this currently is not normal practice.

The toxicity standard system has the potential to capture the effects of different environmental settings. Toxicity tests are conducted by diluting effluents with variable amounts of water. The water can either be obtained from an independent waterbody or from the receiver itself. In the former case, the chemistry of the diluting water can be adjusted to mimic that of the receiver. With both types of tests, the effects of the receiving waterbody chemistry can be captured; however, it is not always standard practice to adjust the diluting water to match the receiver. Also, there is the potential that non-typical constituents in the receiver could alter the toxicity of effluents and these may not be added to the diluting water. Ideally, water from the receiving waterbody should be used to conduct the tests but practical difficulties in obtaining adequate samples and in interpreting the results present significant constraints in some cases.

In conclusion, all systems have the potential to deal with different environmental settings with the toxicity standards approach being most flexible. However, often this consideration is not addressed by any of the systems.

C.1.3 Complementarity This evaluation criterium is effectively non-operative in differentiating between the advantages and disadvantages of the three systems. The criterium relates to compatibility with the BAT(EA) limits being derived under MISA within the "technology track". All of the approaches are equally complementary with BAT(EA) limits.

C.1.4 Enforceability For standards to be enforceable, they must have several characteristics including:

i) precise and, preferably concise, definition
ii) reliable method of measurement
iii) rational defensible basis for limits (ie, a relationship between the standard and a corresponding potential environmental effect can be demonstrated).

Chemical-specific limits can be precisely and concisely defined and generally, reliable analytical procedures are available. The definition of toxicity limits is equally strong and toxicity testing procedures have been standardised to the point that they are comparable in replicability to most chemical-specific tests. As result, all three systems are comparable with respect to these qualities.

The major difference among the systems relates to the last characteristic. Central to the principle of defensibility is the requirement of a consistent and unambiguous decision process leading to a standard. For example, a standard would be less defensible if it varied without good reason from one case to another. Defensibility is strengthened if it can be shown that the standard setting process is open to the public and all dissenting opinions have been considered in reaching a decision.

These are the strengths of the Michigan system. By developing a generic explicit system, public input is streamlined without restricting access to subsequent decisions. The Michigan approach not only explicitly documents the scientific information on which a standard is derived but also sets out in a clear, consistent procedure whereby the information will be used to reach a decision. In Ontario, usually the scientific information used to reach a decision is well documented but there is not a standard, clear and consistent framework used to reach a decision. This weakness is currently being overcome somewhat through the standardization of the process but the means for public input to decisions on individual standards has not been confirmed. Accordingly, the Michigan system is considered to be more effectively enforceable than the current Ontario standard setting approach.

The toxicity standard approach is superior to both of the other systems. As mentioned previously, the basis for toxicity standards is not scientific information *per se* but rather public policy (i.e., one of resource allocation). Accordingly for a toxicity standard to be challenged, one would need to demonstrate that the underlying social values reflected in the standard were faulty, a formidable task. If adequate public input to the setting of toxicity standards can be shown, it is difficult to conceive of a successful challenge.

C.1.5 Consistency A central element to fairness is consistency. Standards should be consistently developed and applied to comparable cases. A major strength of explicit decision processes is that they facilitate consistency. The Michigan system is an excellent example of an explicit and consistent decision process. Standards for all contaminants are derived using a uniform approach which ensures that factors such as social values, risk and uncertainty are treated consistently in all cases.

With the Ontario system, it is not as easy to determine that consistent decision criteria and weights have been used to derive each standard. The final decision on each standard is reached by a panel of experts familiar with a specific contaminant. Since the panel for each contaminant will likely comprise different experts, the likelihood for differing weights and, perhaps even decision criteria, is high. As a result, the likelihood for inconsistency among the standards is high. It is concluded that the Michigan system is superior to the current Ontario system with respect to consistency.

Consistency with the toxicity standard approach is easier to achieve than with either of the other two systems. Maintaining consistency becomes increasingly difficult as the number of decisions increases. With the toxicity standard approach, individual decisions on standards for each contaminant are not required; only two decisions are necessary, that is acceptable acute and chronic toxicity limits. (If acceptable tests for other effects were available, the number might increase to about six.)

C.1.6 Cost Effectiveness Cost effectiveness relates to the time and data required to derive a standard. Both the Michigan and Ontario systems are comparable in terms of data requirements; however, the relatively straightforward and mechanical approach used in Michigan is highly efficient in synthesising scientific information in a form suitable for reaching a decision on a standard. Much of the work compiling technical information can be done by technical staff. Expert input is directed to key decision points and can be efficiently utilised. Likewise, public review is greatly facilitated by providing a clearly documented decision process. Reviewers need not recreate the decision process each time and can instead focus on key discretionary inputs (eg, uncertainty factors).

Toxicity standards are the most cost effective of the standard setting processes. Not only are the number of standards required significantly less than with the other systems, toxicity standards can be decided upon virtually in the complete absence of scientific information on specific effects. The key input is the views of decisionmakers as to the acceptable level of environmental quality.

C.1.7 Technical Soundness A common objection to a structured standard setting procedure like that used in Michigan is its inability to accommodate special considerations associated with specific contaminants. Clearly, this is an important factor; however, it is tractable within an explicit decision process. For example in Michigan, all standards undergo a final review to ensure that no special circumstances have been overlooked in the process (see Figures B.1 to B.4 in Appendix B). Also, any decision process should be designed for periodic updating as experience is gained. If a recurrent omission or weakness is evident, then the process is modified accordingly. By incorporating this accumulated experience in the system, the overall decision process will improve with time. This is not necessarily so with an implicit system.

A technical strength of an explicit system is the certainty that all factors included have been given full consideration. The potential for omissions is less.

Technical soundness is not a major concern with toxicity standards since the fundamental basis for them is technically relatively trivial. It would be difficult to argue that, for example, an acute toxicity standard was technically invalid rather one would need to show it did not reflect public will and desire.

C.1.8 Clarity and Simplicity Clarity and explicitness are somewhat synonymous; the explicit standard setting procedure used in Michigan is arguably easier to trace than that used in Ontario and hence is clearer to the public. The underlying decisions associated with a specific standard can be derived with the Michigan system. This is not the case with the

Ontario system due to the large number of potential decision points and the absence of a structural decision process.

However, both systems are based on fairly complicated technical data and deductive analysis. Accordingly, they are relatively complex from the perspective of most members of the public. Also they are clearly inferior to the toxicity standard approach in terms of clarity. The simplicity of the toxicity standard setting process enhances its clarity. The toxicity standard approach focusses the decisionmakers' and the public's attention to primary decision points without necessitating that one become entangled in the technical complexity of scientific data.

C.1.9 Conclusion The toxicity standard approach is clearly superior with respect to all evaluation criteria used in this analysis except for comprehensiveness of impact types. Chemical-specific standards are required to deal with impacts other than acute and chronic toxicity effects on aquatic ecosystems.

The explicit standard setting approach used by Michigan is superior to that currently in use in Ontario with respect to the evaluation criteria. Modifications to the system to encourage periodic updating and to establish standards for different chemical and physical environments would enhance the utility of the approach.

C.2 Effluent Limits

The two alternatives available for setting effluent limits, namely whole-effluent and chemical-specific limits, are parallel in many respects to those considered for setting water quality standards. Consequently, there is considerable overlap in the evaluation of the systems. In the following sections, only evaluation criteria are discussed for which additional comments are applicable.

C.2.1 Consistency Since the range of tests associated with toxicity measurements are quite limited (i.e., chronic and acute toxicity), it is straightforward to ensure that all effluents receive the same level of control with the whole-effluent approach. Ensuring consistency among discharges is more difficult with chemical-based limits due to the wide variety of chemicals and analytical procedures potentially involved. If a discharger and the regulatory agency are unaware of the presence of a contaminant, then it is unlikely that an effluent limit will be specified. However, in another case, the pollutant may have been identified and a limit imposed. Inconsistency among discharge limits may inadvertently result due to such information constraints.

C.2.2 Cost Effectiveness The cost effectiveness of the two approaches depends to a large extent on the complexity of the effluent and the required sampling and analysis procedures. As the complexity of the effluent increases, whole-effluent tests become increasingly cost effective. Also as the frequency of sampling increases, whole-effluent analytical techniques will be preferred in some cases. This is particularly the case where virtual continuous monitoring is required.

C.2.3 Conclusions Whole-effluent limits are most effective in situations involving complex effluents. They are generally superior to chemical-specific limits for regulating acute and chronic toxicity impacts to aquatic ecosystems but chemical-specific limits are required for human health and persistent contaminant bioaccumulation impacts.

APPENDIX D

CASE STUDY RESULTS

The purpose of the case studies was to examine in detail the operational aspects of various U.S. administrative procedures designed to set toxic effluent limits. A cross-section of representative permits was desired to evaluate the effects of various factors on the process. The following summarizes the results of case studies for four states, namely, New Jersey, North Carolina, Michigan, and Florida. State environment departments issue permits for New Jersey, North Carolina and Michigan; Florida permits are issued by Region IV of the U.S. EPA.

The chapter is structured according to the main headings of the survey form (see Table D-2, p. D-14). Brief comparisons within and among states are presented for each major category. A copy of the interviewer instructions is appended and this should aid in interpretation of any unclear categories.

D.1 Survey Procedure

Officials with each of the state departments responsible for issuing NPDES permits were contacted by telephone to determine the availability of suitable permits and to solicit their cooperation in the investigations. Positive responses were obtained from all departments and arrangements were made to personally visit each office to review and obtain relevant information. State officials were apprised of the purpose of the case studies and they were asked for suggestions as to potentially suitable permits.

The first task during the on-site visits was to select the most representative permits for the case studies. For selected permits, the files were reviewed in terms of background information, applications and supporting reports and department procedures used to set effluent limits and obtain final approval.

Subsequent to the initial case studies from Michigan, New Jersey and North Carolina, it was decided to include several permits from Florida, where there is considerable experience implementing both acute and chronic toxicity whole-effluent limits. Also, because permits in Florida are issued by Region IV of the U.S. EPA, inclusion of Florida permits permitted observation of the implementation of the TSD procedures as set out without the complexity of state-specific interpretations. However, it was not possible to conduct personal interviews with appropriate officials, and thus the review of the Florida permits is based on examining excerpts of permits provided to the consulting team by R. Scroggins of Environment Canada. Marshall Hyatt of Region IV is involved in permit approvals for Florida and he attended the workshop. Informal discussions with him provided further understanding of how the Florida system operates.

Several considerations should be borne in mind when reviewing the remainder of this appendix.

D.1.1 Different Interviewers Case studies for each state were prepared by different members of the consulting team. Explicit instructions were circulated to interviewers and these aided significantly in facilitating consistency. There are some apparent differences. This is partly due to differing interpretations of the questionnaire categories but is due in greater part to the differing procedures used by each state.

D.1.2 Limited Choice Several factors limited the available choice of permits. First, agency officials performed the initial screening such that only a limited number of permits were potentially available for review. The interpretations of these officials in terms of the desired types of permits had a significant influence on the actual permits selected.

Second, the introduction of whole-effluent limits is relatively recent and accordingly, few permits offer an extended compliance history. Furthermore, not all permits are based on the most up-to-date procedures (e.g., permits are reissued every 5 years normally).

D.1.3 Different Methodologies Information on permits from Michigan, New Jersey and North Carolina was based on personal interviews with officials in those states. Information on permits from Florida is based solely on a review of excerpts of selected permits.

D.2 Summary of Case Study Permits

Each of the following subsections correspond to a major survey category. For each, the results are briefly discussed and major deficiencies and observations are highlighted. Table D-1 sets out the criteria used to select a representative cross-section of permits.

D.2.1 Receiving Waterbody All of the permitted effluents discharged either into flowing waterbodies or saline systems. The latter were not desired. A specific attempt was made to obtain permits for discharges to large lakes but none were identified by the states. A broad range of river sizes was obtained from small, effluent-dominated creeks to major river systems.

Few agencies had information on hand regarding upstream discharges and overall water quality. This general lack of information has significant implications for developing waste load allocations (WLA): Essentially, the effect of upstream dischargers on ambient conditions would be quite difficult to incorporate in the effluent limits and a specific WLA was not performed for any of the permits.

Little variation in the designated uses of the receiving waters is present; most are designated for body-contact recreation (BCR) and resident and migratory fish (FR,FM). Generally, these designated uses had little effect on the effluent limits specified.

D.2.2 Industry/Municipal Description A cross-section of discharge sizes and types was obtained. Four permits were for publicly-owned treatment works (POTW) and another 3 were for major organic chemical producers. Organics were a major constituent in many effluents although one was dominated by inorganics and inorganics comprised significant components of several other discharges.

A major deficiency was a dearth of information regarding effluent volume and contamination variations. Most data came from monthly operating reports prepared by industry using data they collected. This is an important observation; this lack of information limits screening for enforcement priorities and the use of effluent simulation models to establish adequate limits.

D.2.3 Effluent Treatment/Discharge A good cross-section of treatment systems was obtained in terms of types and design capacities. This was not the case in terms of outfalls. Most were simple surface discharges; however, three discharges used more sophisticated diffusers on their outfalls.

D.2.4 Permit Characteristics This is an essential section of the survey form. Despite efforts to obtain permits with toxicity limits, of the State agencies, only New Jersey had implemented them and then only for acute toxicity. Little insight was offered as to the logistical requirements to implement whole-effluent limits. The New Jersey permits were the most comprehensive in terms of the toxicity limits specified. However, the derivation of the limits themselves was not receiving-water specific; the state standard of 50% 96 h LC50 is applied to all discharges uniformly. One of the four Florida permits included an acute toxicity limit, but it too did not appear to be based on considerations specific to the receiving waterbody.

Three of the four Florida permits reviewed contained an whole-effluent chronic toxicity limit. The other Florida permit indicated that chronic toxicity limits were not required because the dilution factor of the receiving river is large and chronic toxicity for the parameters of concern is not indicated.

Monitoring requirements varied widely in terms of tests specified and sampling frequency. New Jersey was the only state requiring Ames tests to monitor for potentially carcinogenic pollutants. North Carolina uses chronic toxicity monitoring quite frequently as a basis to identify problem discharges.

Generally, the sampling frequency for toxics was low. With this frequency, characterization of effluent toxicity variation would be quite crude and a long record (e.g., at least 5 years) would be required to obtain a general sense of variations (presuming the samples are truly random). However, several of the permits contained provisions for increasing the frequency of sampling if non-compliance is detected.

Responsibility for most monitoring was allocated to the discharger; state agencies served primarily an "auditing" function to confirm the accuracy of discharger samples. The responsibility of dischargers was determined to extend well beyond the "end of pipe"; receiving water biological surveys were required of dischargers in several cases.

All permits reviewed for New Jersey, Michigan and North Carolina were issued by state authorities using a combination of state and federal procedures. The Florida permits reviewed were issued by the U.S. EPA and used both EPA and Florida procedures.

D.2.5 Permit Writing As was partly anticipated, available data on resources required for permit preparation were generally quite limited. This category had one of the greatest frequencies of "not available" (N/A) responses.

A problem arose in separating out the time spent dealing with conventional pollutants or setting limits using BATEA or other criteria. Time accounting is generally not recorded by these activities.

Virtually no information regarding the time spent by other parties in the permit preparation process was available from the state agencies. Overall, the results for this category are of limited value in developing an understanding of resource requirements for implementing a similar system[1].

Only 5 of the 14 permits examined were issued before 1986 and the earliest was May, 1984. One of the Florida permits reviewed had not been finalized.

A hearing was required for only one of the permits and this was not a judicial proceeding; it was a "discovery" process to determine the concerns of various parties. This hearing involved considerable debate and was quite thorough. The hearing documentation provides useful reference regarding challenges to toxicity limits and New Jersey's responses. Many of the issues raised at the hearing are reviewed in Appendix E.

The level of technical sophistication used to develop effluent limits was generally quite limited. For example, models were generally not used and primary reliance was placed on conventional standards and simple estimation methods. In virtually all cases, standard procedures were used to develop effluent limits and no special provisions were made.

D.2.6 Compliance and Enforcement The short period during which the permits have been in force was a major limitation to evaluating their compliance and enforcement performance. This combined with the limited number of permits with toxicity limits effectively negated any conclusions being drawn based on the reported results.

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[1] Parallel to the case studies, gross staff and resource requirements were discussed with agency officials at the Receiving Water Based Effluent Control Workshop held as part of this project on 3 April to 5 April 1987. The reported resource requirements are discussed in Section 9.7 (p.55) of the report.

D.3 Conclusions

The case studies proved to be of limited utility in achieving their intended purpose. The primary results of value are the actual limits developed and the wording used to define effluent limits. The paucity of whole-effluent limits in combination with few older permits were the major limitations.

D.4 INTERVIEWER INFORMATION

Context of Project

All interviewers should read the introduction and work program contained in the proposal prepared for this study before any case study investigations are undertaken. Also the TSD for Water Quality-based Toxics Control should be examined to obtain a technical appreciation for the issue.

The purpose of the case studies is to provide us (the consultants) with an appreciation of the implementation requirements for and effectiveness of toxicity-based effluent control programs. All questions should be formulated with the perspective of gaining an understanding of the actual formulation and implementation of the permit rather than what is supposed to happen.

We are not looking for biased answers (e.g., ones attempting to make the process look better than it is). Instead, we wish to obtain an indepth understanding of the strengths and weaknesses so that they can be anticipated and rectified, if similar approaches are used in Ontario.

In filling out the form, imagine that you were responsible to implement a new toxics control program and the type of information that you would wish to know.

Evaluation Survey Format

The survey form is organized into 7 major headings:

1) Receiving Waterbody
2) Industry/Municipal Description
3) Effluent Treatment/Discharge
4) Permit Characteristics
5) Permit Writing
6) Compliance and Enforcement
7) Opinions of Interviewee

We plan to include the forms as an appendix to our report so that they should be filled out as completely as possible. However, do not feel bound strictly by the format. It is suggested that notes be kept in addition to filling out the form itself. Where possible the notes should be indexed to the headings and subheadings of the form.

In some of the following instructions, it is suggested that the interviewer undertake some probing to gain a better appreciation of specific matters. The answers to supplementary questions should be kept as separate notes. Excessively extensive documentation is much better than the converse. Try to keep notes of all discussions.

The following sections describe what is required for each entry on the form. The subheadings refer to specific sections of the form.

1) RECEIVING WATERBODY

This section provides data on the characteristics of the receiving waterbody that might influence the nature of the permit. Information on water quality, quantity and biology/use is required.

a) Only one of these choices should be indicated. For lakes, estuaries and impoundments, approximate surface area estimates would be useful. Embayments are where circulation with the main water system is restricted such that the embayment volume is used to estimate available dilution.

b) Specific values should be entered for each of these categories. Total volume only applies to lakes and impounded systems.

c) i) Approximate areas by land use categories are desired. If detailed water chemistry data are available obtain these and the percentages by land use category would be optional.

ii) The total number of each type of upstream discharge should be recorded. Where there are multiple discharges for each type, the size range of the discharges should be approximated as to largest, smallest and average by discharge volume.

iii) In the U.S. literature we have come across reference to setting standards according to designated water uses (e.g., see TDS pg.9). There may be other categories for individual states and these should be written in where appropriate. If there is literature describing the procedure for designating waterbody uses this should be obtained.

2) INDUSTRY/MUNICIPAL DESCRIPTION

a) This should include only production employees at the specific plant site being permitted. If it is a POTW, then the population serviced should be entered.

b) If a Standard Industrial Code designation is available please record. Otherwise a narrative description (e.g., organic chemical producer, petroleum refining) should be entered. The more description the better. POTWs will be shown as "municipal".

c) The purpose of this information is to obtain some understanding of the types of production processes that are likely used by the plant. We felt it would be too complicated to list the processes and have used product types as a surrogate.

For POTWs, a proportion of the total flow coming from industrial sources would be useful. If further definition of the industrial users of a system is readily available, it should be noted.

d) A start up year is adequate.

e) The quality and extent of these data may well vary significantly. If an extensive effluent characterization data base is available please indicate and try to distill out the primary constituents used to develop the permits. Otherwise, use your best judgement and the information available to give some sense of the chemical nature of the effluent.

f) Even less information is likely available for these characteristics. Of particular importance is how variations in effluent quality and quantity were characterized for setting permit limits. Judgement will likely be required to complete this section plus some probing with technical support and permit writing staff.

3) EFFLUENT TREATMENT/DISCHARGE

a) The matter of waste treatment technologies is quite complex. If specific information is available, please record. You may note whether the facility has BAT equipment installed. The treatment technology description should be somewhat generic (e.g., activated sludge, reverse osmosis) and need not include a detailed unit process description.

b) These entries are all quite self-evident. Approximation may be necessary in some cases.

c) Some outfalls have rapid mixing diffusers to minimize the local impact of effluent. Be as descriptive as possible as to any special measures used to enhance mixing and diffusion.

4) PERMIT CHARACTERISTICS

Much of the information in this section can likey be obtained directly from the actual permits.

a) In the TSD and other supporting documentation, considerable attention is given to the concept of concentration limits, allowed exeedance durations and frequency of exceedance. This combination of factors lead to the legal definition of compliance and are central to any prosecution attempts for violations. We wish to obtain a clear description of how compliance is determined. This may include follow-up testing to confirm violations, etc.

Several specific points should be considered.

i) Concentration - There may be significant difference between an exceedance by 10% of a maximum limit and a 100% exceedance. How is the magnitude of the exceedance dealt with in the definition of compliance?

ii) Exceedance Frequency - Provision for exceptional cases of exceedance is made and is based on probabilistic concepts. If an exceedance frequency of, say, once every three years is used, how are recurrent exceedances dealt with?

For example, Plant A may have an exceedance in year 1 and year 2 and not another till year 8. Depending on how exceedance frequency was defined (e.g., 1 per 2 years), the firm may or may not be in compliance.

Some interpretation of the wording of the permit will be required to clarify this point.

b) "Type" refers to the type of tests required (e.g., Ames test, 96 hour LC50).

"Frequency" is how often samples are required to be tested.
"Responsible organization" should indicate who pays for the analyses to be performed.

Presumably these tests are performed using effluent at the end of pipe. If otherwise please indicate.

"Receiving body biology" refers to monitoring studies of the aquatic ecology below the outfall. Common tests would include fish contamination, benthic diversity and abundance, bioaccumulation in sensitive species (e.g., mussels). The description of receiving water biology monitoring may require more narrative description than some of the others.

c) This is the agency who issued the permit.

d) Enter the identifier used by the agency for permits. This will ensure that the forms are related to the appropriate permits.

5) PERMIT WRITING

This section is intended to document the time and resources required to develop the permit from start to finish.

a) The first two sections provide a measure of the amount and quality of data used to develop the permit. Under "Scale" a numerical ranking from 0 to 10 should be used "0" denotes no data were available and 10 a complete data set was on hand. "Source" is where the data were obtained (e.g., existing govenment report, company files).

b) "Numbers" is the number of each type of sample collected specifically for the purposes of preparing the permit. "Type" refers to the type of sample and tests used.

c) + d) These dates refer to the time the permit writing procedure was intiated and was terminated. The full period should be recorded including preliminary negotiating and preparation time.

e) Total mandays should be included as much as possible. This may require some probing to ensure that an accurate reflection of the human resource commitment is obtained. These numbers are particularly important for planning purposes and reasonable efforts should be made to accurately estimate these numbers.

f) Hearings may be required by some jurisdictions. Explanatory notes on the procedure would be useful. Where a hearing is required, the results in terms of the characteristics of the permit should be noted.

g) The U.S. EPA has issued a number of technical documents describing the procedures for setting limits (e.g., TSD). Also some states have their own guidelines. If separate state guidelines are available, please obtain these and forward to us with the completed evaluation form.

h) Models may be used to estimate some factors used to net limits. Try to obtain the supporting technical documentation if available. If standard models are used please note.

i) Design criteria include a potentially wide range of factors (e.g., safety factors, design flow frequencies, acceptable risk values). This section is somewhat vague by necessity; it includes the "grey" areas (ie, those based on judgement and values rather than hard scientific rationales). Design criteria are a potentially contentious issue and attention should be given to documenting assumptions both explicit and implicit embedded in such criteria.

j) This is a narrative section. Please note any deviations from the normal permit development procedure and the reason for these. Do not limit the narrative by the space provided.

6) COMPLIANCE AND ENFORCEMENT

This section deals with the administration of the permit after it is issued. This information is critical; the responses here will be used as primary measures of the effectiveness of the process in achieving environmental protection objectives.

a) The permit will have specified certain monitoring requirements. This section provides an indication of the results of this monitoring. Number and type of violation will indicate where a deviation from the permit requirements has been recorded. The type of violation could range from non-reporting to repeated exceedances above the specified frequency.

b) Where violations have been reported, the associated enforcement activities should be reported. Additional narrative of follow-up enforcement and the violations themselves may be required. Outcome should indicate what resulted from the enforcement activities.

As part of this section, try to determine the reporting requirements of a firm when an exceedance is noted. What actions are required? When? By whom? What contingency and remedial measures are required?

7) OPINIONS OF INTERVIEWEE

This section consists of a series of narrative, open-ended questions to pose to persons familiar with the specific permit and their views based on the experience gain from this and other similar permits. You may need to complete a separate Section 7 for several individuals involved with a permit. If the same individual is involved with several permits and the opinions regarding each are essentially the same, the sections should not be repeated on each form. Simply refer to the master form. However, if there are comments specific to the permit, they should be recorded here.

The entries below the dotted line on page 5 should be filled out by the interviewer after the data have been collected. Elaboration on the reliability and interpretation of the responses will be welcomed.

TABLE D-1

CASE STUDY SELECTION CRITERIA

Regional District:
- Michigan
- New Jersey
- North Carolina
- Florida

Receiving Waterbody;
- River
- Lake
  - open water
  - embayed

Industry/Municipal Characteristics:
- size
  - large
  - small
- production processes
  - organic effluents
  - inorganic effluents
- effluent chemistry
  - simple
  - complex
- waste treatment process
  - primary
  - secondary

Designated Water Use:
- potable/recreation
- fisheries

Availability of Data:

Approval Status:
- permit issued
- permit refused

Table D-2: Summary of Case Study Permits

	New Jersey		North Carolina			
Response Categories	1	2	1	2	3	4
1. RECEIVING WATERBODY						
a. Type	Ocean	Estuary	River	River	Creek	Creek
b. Hydrology 1. Watershed (km2)	N/A	17699	1848	1	3	3
2. Flow (l/s)	N/A	N/A	21521	11	41	28
3. Volume	N/A	N/A	N/A	N/A	N/A	N/A
c.1 Water Quality - Land Use						
1. Urban	N/A	yes	10%	0%	0%	60%
2. Suburban	N/A	yes	N/A	5%	5%	30%
3. Agric. crops	N/A	yes	50%	30%	40%	0%
Agric. pasture	N/A	yes	20%	40%	45%	0%
4. Forest	N/A	yes	20%	25%	10%	10%
c.2 Water Quality - Discharges - #						
1. Industrial	N/A	yes	N/A	none	none	none
2. Municipal	N/A	yes	1	none	none	none
3. Other	N/A	diversions	N/A	none	none	none
Upstr Discharges-Vol Avg (m3/d)						
1. Industrial	N/A	N/A	N/A	N/A	N/A	N/A
2. Municipal	N/A	N/A	27125	N/A	N/A	N/A
3. Other	N/A	N/A	N/A	N/A	N/A	N/A
c.3 Receiving Waterbody - Use Class	BCR, FR, FM	BCR, FR, FM (class 5)	Swamp	?	?	nutr-sensitive
2. INDUSTRY/MUNICIPAL DESCRIPTION						
a. Number of Employees	1000	3000	200 t/d	N/A	N/A	3000
b. SIC or Ind. Sector Type	2865,2821,2869	28	Pulp producer	textiles	POTW	POTW
c. Major Product(s)	org.dyes/pharm	org chem	Pulp	cotton	10%-industrial	60%-industrial
d. Operation started	1952	<1900	1968	mid 60's	1984	1983-upgraded
e. Volume and Contaminants - # 1						
1. Volume (m3/d)	see NJ-1	see NJ-2	N/A	N/R	3100	2558
2. Contaminants	see NJ-1	see NJ-2	BOD5,TSS,NH3	N/R	N/R	N/R
f. Var. in Effl.-Frequency						
1. Contaminants	N/R (DMR)	N/R (DMR)	N/R	N/R	N/R	N/R
2. Quantity	N/R (DMR)	N/R (DMR)	N/R	N/R	N/R	N/R
Var. in Effl.-Range						
1. Contaminants	minor (<50%)	see NJ-2	100%	N/R	N/R	N/R
2. Quantity	minor (<50%)	see NJ-2	N/R	N/R	N/R	N/R
3. EFFLUENT TREATMENT/DISCHARGE						
a. Waste Treatment Technology						
1. Type	Neut,1ry+2dry	neut,3ry w/CA	Aer basin+clar	Aer basin+clar	Oxidatn Ditch	aeration basin
2. Design Cap (m3/d)	38750	174375	6200	271	5813	4650
3. Cont.Rem.Eff.	80% (BOD)	82% (BOD)	98% (BOD), 36%	N/R	N/A	N/A
b. Loc. of Outfall - Depth	N/R	N/R	N/R	surface	N/R	N/R
- Location	bottom	bottom	N/R	N/R	N/R	N/R
- Offshore Dist	762 ft	152 ft	N/R	shoreline?	N/R	N/R
c. Type of Diffuser	multiport(50)	single port	N/R	N/R	N/R	N/R
4. PERMIT CHARACTERISTICS						
a. Limits - Concentration/Load						
1. Chemical Spec.	see NJ-1	see NJ-2	N/A	see NC-2	see NC-3	see NC-4
2. Toxicity - Acute	see NJ-1	see NJ-2	N/A	none	none	none
- Chr.	no	no	N/A	none	none	none
3. Bioaccumulation	no	no	N/A	none	none	none
4. Genotoxicity	no	no	N/A	none	none	none
b. Monitoring - Type						
1. Chemical Specific	see NJ-1	see NJ-2	N/A	see NC-2	see NC-3	see NC-4
2. Toxicity - Acute	5%>50% 96LC50	50% 96LC50	N/A	90% 48LC50	none	none

Table D-2: Summary of Case Study Permits

	< New Jersey >		< North Carolina >			
Response Categories	1	2	1	2	3	4
- Chr.	no	yes	Ceriodaphnia	none	>94% 48ChV	>99% 48ChV
3. Bioaccumulation	no	no	N/A	none	none	none
4. Rec.Body Biology	water quality	see NJ-2	N/A	none	none	none
5. Genotoxicity	Ames	see NJ-2	N/A	none	none	none
Monitoring - Frequency						
1. Chemical Specific	see NJ-1	see NJ-2	N/A	see NC-2	see NC-3	see NC-3
2. Toxicity - Acute	1/mth>2/mth	1/month	N/A	1/3 months	N/A	N/A
- Chr.	N/A	1/3 months	1/3 months	N/A	1/3 months	1/3 months
3. Bioaccumulation	N/A	no	N/A	N/A	N/A	N/A
4. Rec. Body Biology	weekly May-Sep	study design	N/A	N/A	N/A	N/A
5. Genotoxicity	1/3 months	1/3 months	N/A	N/A	N/A	N/A
Monitoring - Organization						
1. Chemical Specific	discharger	discharger	N/A	discharger	discharger	discharger
2. Toxicity - Acute	discharger	discharger	N/A	discharger	N/A	N/A
- Chr.	N/A	discharger	discharger	N/A	discharger	discharger
3. Bioaccumulation	discharger	N/A	N/A	N/A	N/A	N/A
4. Rec. Body Biology	discharger	discharger	N/A	N/A	N/A	N/A
5. Genotoxicity	discharger	discharger	N/A	N/A	N/A	N/A
c. Regulating Agency						
1. Federal						
2. State	NJ DEP	NJ DEP	NC DNRCD	NC DNRCD	NC DNRCD	NC DNRCD
d. Permit Number/Code	NJ0004120	NJ0005100	NC0005321	NC0025135	NC0026646	NC0021474
5. PERMIT WRITING						
a. Av. Data When Permit Prepared						
1 Effluent - Scale						
1. Quantity	10	6	N/R	N/R	N/R	N/R
2. Quality	10	6	N/R	N/R	N/R	N/R
Effluent - Source						
1. Quantity	DMR	DMR	N/R	N/R	N/R	N/R
2. Quality	DMR	DMR	N/R	N/R	N/R	N/R
2 Receiving Water Body- Scale						
1. Quality Data	1	1	N/R	N/R	N/R	N/R
2. Quantity Data	1	1	N/R	N/R	N/R	N/R
3. Biology Data	1	1	N/R	N/R	N/R	N/R
Receiving Water Body- Source						
1. Quality Data	N/A	N/A	N/R	N/R	N/R	N/R
2. Quantity Data	N/A	N/A	N/R	N/R	N/R	N/R
3. Biology Data	N/A	N/A	N/R	N/R	N/R	N/R
b. Testing Undertaken						
1 Effluent - Number						
1. Chemical	yes (N/R)	yes (N/R)	N/R	N/R	N/R	N/R
2. Tox. - Acute	yes (N/R)	yes (N/R)	N/R	7	yes (N/R)	yes (N/R)
- Chronic	no	yes (N/R)	yes (N/R)	yes (N/R)	N/R	N/R
Effluent - By Whom						
1. Chemical	dischr/govt	discharger	N/A	N/A	N/A	N/A
2. Tox. - Acute	dischr/govt	discharger	N/A	NC DNRCD	NC DNRCD	NC DNRCD
- Chronic	N/A	N/A	N/A	N/A	N/A	N/A
2 Receiving Water - Number						
1. Chemical	N/A	N/A	N/A	yes (N/R)	N/A	N/A
2. Tox. - Acute	N/A	N/A	N/A	N/A	N/A	N/A
- Chronic	N/A	N/A	NC DNRCD	N/A	N/A	N/A
3. Biological	N/A	N/A	N/A	yes (N/R)	N/A	N/A
4. Quantity	N/A	N/A	N/A	N/A	N/A	N/A
Receiving Water - Type						
1. Chemical	N/A	N/A	N/A	yes (N/R)	N/A	N/A

	New Jersey		North Carolina			
Response Categories	1	2	1	2	3	4
2. Tox. - Acute	N/A	N/A	N/A	N/A	N/A	N/A
- Chronic	N/A	N/A	N/R	N/A	N/R	N/R
3. Biological	N/A	N/A	N/A	benthos	N/A	N/A
4. Quantity	N/A	N/A	N/A	N/A	N/A	N/A
Receiving Water - By Whom						
1. Chemical	dischr/govt	N/A	N/A	NC DNRCD	N/A	N/A
2. Tox. - Acute	dischr/govt	N/A	N/A	N/A	N/A	N/A
- Chronic	N/A	N/A	NC DNRCD	N/A	N/A	N/A
3. Biological	N/A	N/A	N/A	NC DNRCD	N/A	N/A
4. Quantity	N/A	N/A	N/A	N/A	N/A	N/A
c. Start of Permit Preparation						
1. Month	N/A	3	N/A	N/A	N/A	N/A
2. Year	1981	1986	N/A	N/A	N/A	N/A
d. Date of Permit Issue						
1. Month	July	DRAFT	September	July	February	November
2. Year	1985	est'd 08/87	1986	1986	1987	1986
e. Est.Mandays - Technical Supp.						
1. Federal	N/A	N/A	N/A	N/A	N/A	N/A
2. State	80	80	3	8	3	3
3. Industry	N/A	N/A	N/A	N/A	N/A	N/A
4. Other	N/A	N/A	N/A	N/A	N/A	N/A
Est.Mandays - Permit Writing						
1. Federal	N/A	N/A	N/A	N/A	N/A	N/A
2. State	160	160	1	2	1	1
3. Industry	N/A	N/A	N/A	N/A	N/A	N/A
4. Other	N/A	N/A	N/A	N/A	N/A	N/A
Estimated Mandays - Other						
1. Federal	N/A	N/A	N/A	N/A	N/A	N/A
2. State	N/A	N/A	N/A	N/A	N/A	N/A
3. Industry	N/A	N/A	N/A	N/A	N/A	N/A
4. Other	N/A	N/A	N/A	N/A	N/A	N/A
f. Hearing required/requested by						
1. Federal		not expected	N/R	N/R	no	no
2. State		not expected	N/R	N/R	no	no
3. Industry	yes	not expected	N/R	N/R	no	no
4. Public	yes	not expected	N/R	N/R	no	no
5. Other		not expected	N/R	N/R	no	no
If yes - outcome of hearing	upheld permit	N/A	N/R	N/R	N/A	N/A
- chang.to permit	yes-more strng	N/A	N/R	N/R	N/A	N/A
g. Technical Procedures Followed						
1. Federal	prop gdlines	prop gdlines	N/R	N/R	N/R	N/R
2. State	yes	yes	N/R	N/R	N/R	N/R
3. Other	BPJ	BPJ+DRBC gdln	N/R	N/R	N/R	N/R
h. Models Used For						
1. Mixing Zone	N/A	N/A	no	no	no	no
2. Design Flow	N/A	N/A	no	no	no	no
3. Exposure	N/A	N/A	no	no	no	no
4. Bioaccumulation	N/A	N/A	no	no	no	no
5. Other	N/A	N/A	no	no	no	no
i. Design Criteria For						
1. Mixing Zone	yes	yes	N/R	N/R	N/R	N/R
2. Design Flow	N/A	N/A	7Q10	7Q10	7Q10	7Q10
3. Safety Factors	N/A	N/A	N/R	N/R	N/R	N/R
4. Uncert. Factors	N/A	N/A	N/R	N/R	N/R	N/R
5. Lev.of Acc.Risk	N/A	N/A	N/R	N/R	N/R	N/R
j. Mod. to procedures and why	no	no	none	none	none	none

Table D-2: Summary of Case Study Permits

	New Jersey		North Carolina			
Response Categories	1	2	1	2	3	4
6. COMPLIANCE AND ENFORCEMENT						
a. Monit. Results - No. of Tests						
1. Chem. Specific	N/A	N/A	N/A	N/A	N/A	N/A
2. Tox. - Acute	N/A	N/A	N/A	N/A	N/A	1
- Chronic	N/A	N/A	N/A	N/A	N/A	N/A
3. Rec. Body Biology	N/A	N/A	N/A	N/A	N/A	N/A
4. Bioaccumulation	N/A	N/A	N/A	N/A	N/A	N/A
5. Genotoxicity	N/A	N/A	N/A	N/A	N/A	N/A
Monit. Results - No. Violations						
1. Chem. Specific	N/A	N/A	N/A	N/A	N/A	N/A
2. Tox. - Acute	N/A	N/A	N/A	N/A	N/A	0
- Chronic	N/A	N/A	N/A	N/A	N/A	N/A
3. Rec. Body Biology	N/A	N/A	N/A	N/A	N/A	N/A
4. Bioaccumulation	N/A	N/A	N/A	N/A	N/A	N/A
5. Genotoxicity	N/A	N/A	N/A	N/A	N/A	N/A
b. Enforcement Activities - Number						
1. Prosecution	N/A	N/A	N/A	N/A	N/A	N/A
2. TRE	N/A	N/A	N/A	N/A	N/A	N/A
3. Other	N/A	N/A	N/A	N/A	N/A	N/A
Enforcement Act. - Outcome						
1. Prosecution	N/A	N/A	N/A	N/A	N/A	N/A
2. TRE	N/A	N/A	N/A	consltnt hired	N/A	N/A
3. Other	N/A	N/A	N/A	N/A	N/A	N/A
7. OPINIONS OF INTERVIEWEE						
Major Strengths of Pres. Appr.	BAT + WET	BAT + WET	N/C	N/C	N/C	N/C
Mod. Req. to Improve System	N/A	N/A	N/C	N/C	N/C	N/C
Accept. of Effl. Control Progr.						
1. By Industry	no	N/R	N/R	N/R	N/R	N/R
2. By Public	no	yes?	N/R	N/R	N/R	N/R
Number of Years Involved	N/R	N/R	N/R	N/R	N/R	N/R
INTERVIEWER	C. Montgomery	C. Montgomery	B. Baetz	B. Baetz	B. Baetz	B. Baetz
AFFILIATION	ELI	ELI	Independent	Independent	Independent	Independent
DATE	870320	870320	870310	870310	870310	870310
INTERVIEW #	NJ-1	NJ-1	NC-1	NC-2	NC-2	NC-2
INTERVIEWEE NAME	F. Stellerine	F. Stellerine	N/R	N/R	N/R	N/R
TITLE			N/R	N/R	N/R	N/R
ORGANIZATION	DEP	DEP	N/R	N/R	N/R	N/R
TELEPHONE NUMBER	609-292-0407	609-292-0407	N/R	N/R	N/R	N/R
Copy of Permit Secured	yes	yes	no	no	no	no
Other Information Received	yes	yes	general condit	gen conditions	gen conditions	gen conditions
Accuracy	Good	Good	average	average	average	average

	<	Michigan		>
Response Categories	1	2	3	4
1. RECEIVING WATERBODY				
a. Type	Creek	River	River	River
b. Hydrology 1. Watershed (km2)	N/A	N/A	N/A	N/A
2. Flow (l/s)	1,075	26,300	5,700	48,100
3. Volume	N/A	N/A	N/A	N/A
c.1 Water Quality - Land Use				
1. Urban	5%	N/A	75% (industry)	10%
2. Suburban	5%	N/A	0%	0%
3. Agric. crops	80%	N/A	25%	10%
Agric. pasture	0%	N/A	0%	10%
4. Forest	10%	N/A	0%	70%
c.2 Water Quality - Discharges - #				
1. Industrial	2	N/A	N/A	N/A
2. Municipal	1	N/A	N/A	minimal
3. Other	none	N/A	N/A	N/A
Upstr Discharges-Vol Avg (m3/d)				
1. Industrial	N/A	N/A	>10	N/A
2. Municipal	N/A	N/A	7750	N/A
3. Other	N/A	N/A	N/A	N/A
c.3 Receiving Waterbody - Use Class	BCR, FR-warm	BCR, FR-warm	BCR, FR-warm	BCR, FR-warm
2. INDUSTRY/MUNICIPAL DESCRIPTION				
a. Number of Employees	100	N/A	N/A	N/A
b. SIC or Ind. Sector Type	3471	POTW	N/A	Org. Chemicals
c. Major Product(s)	Metal Plating		purge well	var. chemicals
d. Operation started	over 20 years	1 year ago	1984	1900
e. Volume and Contaminants - # 1				
1. Volume (m3/d)	1507	2340	13,644	see M-4
2. Contaminants	Cr, Cu, Ni	PCB,org,metals	var. organics	see M-4
f. Var. in Effl.-Frequency	in exceedance			N/A
1. Contaminants	100% of time	average	fairly const.	N/A
2. Quantity	N/A	N/A	N/A	N/A
Var. in Effl.-Range				
1. Contaminants	N/A	N/A	N/A	N/A
2. Quantity	+/- 50% of avg	N/A	N/A	N/A
3. EFFLUENT TREATMENT/DISCHARGE				
a. Waste Treatment Technology				act.sludge,pre-
1. Type	Neut/prec/sed	advanced WWTP	AC,air strip	treat,stab.pond
2. Design Cap (m3/d)	N/A	N/A	N/A	N/A
3. Cont.Rem.Eff.	N/A	N/A	N/A	N/A
b. Loc. of Outfall - Depth	drain dis. pt.	surface	surface	1 m.
- Location	N/A	N/A	N/A	N/A
- Offshore Dist	N/A	shoreline	shoreline	2/3 across riv.
c. Type of Diffuser	N/A	none	none	grav. diffuser
4. PERMIT CHARACTERISTICS				
a. Limits - Concentration/Load				
1. Chemical Spec.	see M-1	see M-2	see M-3	see M-4
2. Toxicity - Acute	N/A	to be added	N/A	N/A
- Chr.	N/A	N/A	N/A	N/A
3. Bioaccumulation	N/A	PCBs	N/A	N/A
4. Genotoxicity	N/A	N/A	N/A	N/A
b. Monitoring - Type				
1. Chemical Specific	see M-1	see M-2	see M-3	see M-4
2. Toxicity - Acute	N/A	to be added	N/A	approved design

	Michigan			
Response Categories	1	2	3	4
- Chr.	N/A	N/A	N/A	approved design
3. Bioaccumulation	N/A	N/A	N/A	see M-4
4. Rec.Body Biology	N/A	N/A	N/A	N/A
5. Genotoxicity	N/A	N/A	N/A	N/A
Monitoring - Frequency				
1. Chemical Specific	see M-1	see M-2	see M-3	see M-4
2. Toxicity - Acute	N/A	to be added	N/A	N/A
- Chr.	N/A	N/A	N/A	N/A
3. Bioaccumulation	N/A	N/A	N/A	2/5 years
4. Rec. Body Biology	1/5 yrs	N/A	N/A	N/A
5. Genotoxicity	N/A	N/A	N/A	N/A
Monitoring - Organization				
1. Chemical Specific	discharger	discharger	N/A	N/A
2. Toxicity - Acute	N/A	to be added	N/A	discharger
- Chr.	N/A	N/A	N/A	discharger
3. Bioaccumulation	N/A	discharger	N/A	discharger
4. Rec. Body Biology	MDNR	N/A	N/A	discharger+MDNR
5. Genotoxicity	N/A	N/A	N/A	N/A
c. Regulating Agency				
1. Federal				
2. State	yes	yes	yes	yes
d. Permit Number/Code	MI-0000825	MI-0023299	MI-0042994	MI-0000868
5. PERMIT WRITING				
a. Av. Data When Permit Prepared				
1 Effluent - Scale				
1. Quantity	10	extensive	good	5
2. Quality	10	extensive	good	5
Effluent - Source				
1. Quantity	discharger	discharger	MDNR	discharger
2. Quality	discharger	discharger	MDNR	discharger
2 Receiving Water Body- Scale				
1. Quality Data	10	N/A	low	N/A
2. Quantity Data	10	N/A	10	N/A
3. Biology Data	10	N/A	not considered	N/A
Receiving Water Body- Source				
1. Quality Data	MDNR	N/A	MDNR	N/A
2. Quantity Data	USGS	N/A	USGS	USGS
3. Biology Data	MDNR	N/A	not considered	N/A
b. Testing Undertaken				
1 Effluent - Number				
1. Chemical	none	6	none	none
2. Tox. - Acute	none	N/A	none	none
- Chronic	none	N/A	none	none
Effluent - By Whom				
1. Chemical	N/A	discharger	N/A	N/A
2. Tox. - Acute	N/A	N/A	N/A	N/A
- Chronic	N/A	N/A	N/A	N/A
2 Receiving Water - Number				
1. Chemical	N/A	N/A	N/A	N/A
2. Tox. - Acute	N/A	N/A	N/A	N/A
- Chronic	N/A	N/A	N/A	N/A
3. Biological	N/A	N/A	N/A	N/A
4. Quantity	N/A	N/A	N/A	N/A
Receiving Water - Type				
1. Chemical	N/A	N/A	N/A	N/A

	< Michigan >			
Response Categories	1	2	3	4
2. Tox. - Acute	N/A	N/A	N/A	N/A
- Chronic	N/A	N/A	N/A	N/A
3. Biological	N/A	N/A	N/A	N/A
4. Quantity	N/A	N/A	N/A	N/A
Receiving Water - By Whom				
1. Chemical	N/A	N/A	N/A	N/A
2. Tox. - Acute	N/A	N/A	N/A	N/A
- Chronic	N/A	N/A	N/A	N/A
3. Biological	N/A	N/A	N/A	N/A
4. Quantity	N/A	N/A	N/A	N/A
c. Start of Permit Preparation				
1. Month	N/A	February	April	June
2. Year	N/A	1986	1985	1983
d. Date of Permit Issue				
1. Month	January	July	November	May
2. Year	1985	1986	1985	1984
e. Est.Mandays - Technical Supp.				
1. Federal	N/A	N/A	N/A	N/A
2. State	10	15	6	50
3. Industry	4	N/A	7	>= state time
4. Other	N/A	N/A	N/A	N/A
Est.Mandays - Permit Writing				
1. Federal	N/A	N/A	N/A	N/A
2. State	N/A	N/A	N/A	180
3. Industry	N/A	N/A	N/A	N/A
4. Other	N/A	N/A	N/A	N/A
Estimated Mandays - Other				
1. Federal	N/A	N/A	N/A	N/A
2. State	N/A	N/A	N/A	6-7
3. Industry	N/A	N/A	N/A	N/A
4. Other	N/A	N/A	N/A	N/A
f. Hearing required/requested by				
1. Federal	none	none	none	N/A
2. State	N/A	N/A	N/A	N/A
3. Industry	N/A	N/A	N/A	N/A
4. Public	N/A	N/A	N/A	N/A
5. Other	N/A	N/A	N/A	public info.
If yes - outcome of hearing	N/A	N/A	N/A	N/A
- chang.to permit	N/A	N/A	N/A	lit./no change
g. Technical Procedures Followed				
1. Federal	N/A	N/A	N/A	N/A
2. State	Rule 57	Rule 57	Rule 57	Rule 57
3. Other	N/A	N/A	N/A	N/A
h. Models Used For				
1. Mixing Zone	mass balance	mass balance	none	none
2. Design Flow	N/A	none	none	none
3. Exposure	N/A	yes	see M-3	N/A
4. Bioaccumulation	N/A	yes	N/A	N/A
5. Other	additive model	yes	none	N/A
i. Design Criteria For				
1. Mixing Zone	25% vol.	25% vol.	25% vol.	25%/75% vol.
2. Design Flow	7Q20	7Q20	7Q20	7Q20
3. Safety Factors	scaling factor	N/A	N/A	N/A
4. Uncert. Factors	none	N/A	N/A	N/A
5. Lev.of Acc.Risk	none	N/A	1/100,000	N/A
j. Mod. to procedures and why	none	yes	N/A	see M-4

Response Categories	<	Michigan		>
	1	2	3	4
6. COMPLIANCE AND ENFORCEMENT				
a. Monit. Results - No. of Tests				
1. Chem. Specific	N/A	N/A	no exceedances	N/A
2. Tox. - Acute	N/A	N/A	N/A	N/A
- Chronic	N/A	N/A	N/A	N/A
3. Rec. Body Biology	N/A	N/A	N/A	N/A
4. Bioaccumulation	N/A	N/A	N/A	N/A
5. Genotoxicity	N/A	N/A	N/A	N/A
Monit. Results - No. Violations				
1. Chem. Specific	N/A	N/A	no exceedances	N/A
2. Tox. - Acute	N/A	N/A	N/A	N/A
- Chronic	N/A	N/A	N/A	N/A
3. Rec. Body Biology	N/A	N/A	N/A	N/A
4. Bioaccumulation	N/A	N/A	N/A	N/A
5. Genotoxicity	N/A	N/A	N/A	N/A
b. Enforcement Activities - Number				
1. Prosecution	N/A	N/A	N/A	N/A
2. TRE	N/A	N/A	N/A	N/A
3. Other	N/A	N/A	N/A	N/A
Enforcement Act. - Outcome				
1. Prosecution	N/A	N/A	N/A	N/A
2. TRE	N/A	N/A	N/A	N/A
3. Other	N/A	N/A	N/A	N/A
7. OPINIONS OF INTERVIEWEE				
Major Strengths of Pres. Appr.	N/A	N/A	N/A	N/A
Mod. Req. to Improve System	N/A	N/A	N/A	N/A
Accept. of Effl. Control Progr.				
1. By Industry	N/A	N/A	N/A	N/A
2. By Public	N/A	N/A	N/A	N/A
Number of Years Involved	12	12	12	12
INTERVIEWER	Ed Hanna	Ed Hanna	Ed Hanna	Ed Hanna
AFFILIATION	JE Hanna Assoc	JE Hanna Assoc	JE Hanna Assoc	JE Hanna Assoc.
DATE	Mar. 11/87	Mar. 11/87	Mar. 12/87	Mar. 12/87
INTERVIEW #	1	2	3	4
INTERVIEWEE NAME	Jim Grant	Jim Grant	Jim Grant	Jim Grant
TITLE	Hd. Tech. Sup.	Hd. Tech. Sup.	Hd. Tech. Sup.	Hd. Tech. Sup.
ORGANIZATION	Mich. DNR	Mich. DNR	Mich. DNR	Mich. DNR
TELEPHONE NUMBER	517-335-4193	517-335-4193	517-335-4193	517-335-4193
Copy of Permit Secured	yes	yes	yes	yes
Other Information Received	yes	yes	yes	yes
Accuracy	N/A	N/A	N/A	N/A

	<	Florida		>
Response Categories	1	2	3	4
1. RECEIVING WATERBODY				
a. Type	River	River	Stream	River
b. Hydrology 1. Watershed (km2)	N/A	N/A	N/A	N/A
2. Flow (l/s)	N/A	N/A	60063	N/A
3. Volume	N/A	N/A	N/A	N/A
c.1 Water Quality - Land Use				
1. Urban	N/A	N/A	N/A	N/A
2. Suburban	N/A	N/A	N/A	N/A
3. Agric. crops	N/A	N/A	N/A	N/A
Agric. pasture	N/A	N/A	N/A	N/A
4. Forest	N/A	N/A	N/A	N/A
c.2 Water Quality - Discharges - #				
1. Industrial		2	3?	3?
2. Municipal	2			
3. Other				
Upstr Discharges-Vol Avg (m3/d)				
1. Industrial	N/A	N/A	N/A	N/A
2. Municipal	N/A	N/A	N/A	N/A
3. Other	N/A	N/A	N/A	N/A
c.3 Receiving Waterbody - Use Class	?	?	?	?
2. INDUSTRY/MUNICIPAL DESCRIPTION				
a. Number of Employees	N/A	N/A	N/A	N/A
b. SIC or Ind. Sector Type	POTW	pulp & paper	Distilling	Transportation
c. Major Product(s)		containerboard	?	
d. Operation started	N/A	N/A	N/A	N/A
e. Volume and Contaminants - # 1				
1. Volume (m3/d)	93	N/A	3.9	N/A
2. Contaminants	BOD5,TSS,TRC	TSS,Chem,Tox	N/A	N/A
f. Var. in Effl.-Frequency				
1. Contaminants	N/A	N/A	N/A	N/A
2. Quantity	N/A	N/A	N/A	N/A
Var. in Effl.-Range				
1. Contaminants	N/A	N/A	N/A	N/A
2. Quantity	N/A	N/A	N/A	N/A
3. EFFLUENT TREATMENT/DISCHARGE				
a. Waste Treatment Technology				
1. Type	N/A	N/A	N/A	N/A
2. Design Cap (m3/d)	N/A	N/A	N/A	N/A
3. Cont.Rem.Eff.	N/A	N/A	N/A	N/A
b. Loc. of Outfall - Depth	N/A	N/A	N/A	N/A
- Location	N/A	N/A	N/A	N/A
- Offshore Dist	N/A	N/A	N/A	N/A
c. Type of Diffuser	N/A	N/A	N/A	N/A
4. PERMIT CHARACTERISTICS				
a. Limits - Concentration/Load				
1. Chemical Spec.	yes	yes	NH_3,DO	conditional
2. Toxicity - Acute	no	yes	no	no
- Chr.	96 h LC50	no	see FL-3	see FL-4
3. Bioaccumulation	no	no	no	conditional
4. Genotoxicity	no	no	no	no
b. Monitoring - Type				
1. Chemical Specific	yes	?	limited	GC/atom.Adsorp
2. Toxicity - Acute	no	yes	no	no

	< Florida			>
Response Categories	1	2	3	4
- Chr.	see FL-1	no	yes	Ceriodaphnia
3. Bioaccumulation	no	no	no	no
4. Rec.Body Biology	no	no	no	yes
5. Genotoxicity	no	no	no	no
Monitoring - Frequency				
1. Chemical Specific	?	?	1/week	see FL-4
2. Toxicity - Acute	N/R	see FL-2	N/R	N/R
- Chr.	see FL-1	N/R	see FL-3	see FL-4
3. Bioaccumulation	N/R	N/R	N/R	see FL-4
4. Rec. Body Biology	N/R	N/R	N/R	"periodic"
5. Genotoxicity	N/R	N/R	N/R	N/R
Monitoring - Organization				
1. Chemical Specific	discharger		discharger	Discharger
2. Toxicity - Acute	N/R	discharger	N/R	
- Chr.	discharger	N/R	discharger	Discharger
3. Bioaccumulation	N/R	N/R	N/R	Discharger
4. Rec. Body Biology	N/R	N/R	N/R	N/R
5. Genotoxicity	N/R	N/R	N/R	N/R
c. Regulating Agency				
1. Federal	EPA	EPA	EPA	EPA
2. State			App. Pending	
d. Permit Number/Code	FL0037966	FL0000892	FL0003051	FL0026042
5. PERMIT WRITING				
a. Av. Data When Permit Prepared				
1 Effluent - Scale				
1. Quantity	N/A	N/A	N/A	N/A
2. Quality	N/A	N/A	N/A	N/A
Effluent - Source				
1. Quantity	FDER			
2. Quality	FDER	FDER/EPA	EPA?	discharger
2 Receiving Water Body- Scale				
1. Quality Data	N/A	N/A	N/A	N/A
2. Quantity Data	N/A	N/A	N/A	N/A
3. Biology Data	N/A	N/A	N/A	N/A
Receiving Water Body- Source				
1. Quality Data	N/R			discharger
2. Quantity Data	N/R			
3. Biology Data	N/R	Consultant		
b. Testing Undertaken				
1 Effluent - Number				
1. Chemical	yes	27 mo.?	N/A	N/A
2. Tox. - Acute		seven	N/A	N/A
- Chronic	yes		N/A	N/A
Effluent - By Whom				
1. Chemical	discharger	FDER/EPA	N/R	N/R
2. Tox. - Acute		FDER/EPA	N/R	N/R
- Chronic	FDER			
2 Receiving Water - Number				
1. Chemical	N/A	N/A	N/A	N/A
2. Tox. - Acute	N/A	N/A	N/A	N/A
- Chronic	N/A	N/A	N/A	N/A
3. Biological	N/A	N/A	N/A	N/A
4. Quantity	N/A	N/A	N/A	N/A
Receiving Water - Type				
1. Chemical	N/A	N/A	N/A	N/A

	< Florida >			
Response Categories	1	2	3	4
2. Tox. - Acute	N/A	N/A	N/A	N/A
- Chronic	N/A	N/A	N/A	N/A
3. Biological	N/A	N/A	N/A	N/A
4. Quantity	N/A	N/A	N/A	N/A
Receiving Water - By Whom				
1. Chemical	N/R	N/R	N/R	N/R
2. Tox. - Acute	N/R	N/R	N/R	N/R
- Chronic	N/R	N/R	N/R	N/R
3. Biological	N/R	N/R	N/R	N/R
4. Quantity	N/R	N/R	N/R	N/R
c. Start of Permit Preparation				
1. Month	N/A	N/A	N/A	N/A
2. Year	N/A	N/A	N/A	N/A
d. Date of Permit Issue				
1. Month	N/A	December	September	September
2. Year	N/A	1985	1985	1984
e. Est.Mandays - Technical Supp.				
1. Federal	N/A	N/A	N/A	N/A
2. State	N/A	N/A	N/A	N/A
3. Industry	N/A	N/A	N/A	N/A
4. Other	N/A	N/A	N/A	N/A
Est.Mandays - Permit Writing				
1. Federal	N/A	N/A	N/A	N/A
2. State	N/A	N/A	N/A	N/A
3. Industry	N/A	N/A	N/A	N/A
4. Other	N/A	N/A	N/A	N/A
Estimated Mandays - Other				
1. Federal	N/A	N/A	N/A	N/A
2. State	N/A	N/A	N/A	N/A
3. Industry	N/A	N/A	N/A	N/A
4. Other	N/A	N/A	N/A	N/A
f. Hearing required/requested by				
1. Federal	N/A	N/A	N/A	N/A
2. State	N/A	N/A	N/A	N/A
3. Industry	N/A	N/A	N/A	N/A
4. Public	N/A	N/A	N/A	N/A
5. Other	N/A	N/A	N/A	N/A
If yes - outcome of hearing	N/A	N/A	N/A	N/A
- chang.to permit	N/A	N/A	N/A	N/A
g. Technical Procedures Followed				
1. Federal	yes	yes	yes	yes
2. State	yes	yes	yes	yes
3. Other				
h. Models Used For				
1. Mixing Zone	N/A	N/A	N/A	N/A
2. Design Flow	N/A	N/A	yes	N/A
3. Exposure	N/A	N/A	N/A	N/A
4. Bioaccumulation	N/A	N/A	N/A	N/A
5. Other	N/A	N/A	N/A	N/A
i. Design Criteria For				
1. Mixing Zone	N/A	N/A	N/A	N/A
2. Design Flow	7Q10	N/A	N/A	N/A
3. Safety Factors	N/A	N/A	N/A	N/A
4. Uncert. Factors	N/A	N/A	N/A	N/A
5. Lev.of Acc.Risk	N/A	N/A	N/A	N/A
j. Mod. to procedures and why	no	N/A	N/A	N/A

Response Categories	Florida 1	Florida 2	Florida 3	Florida 4
6. COMPLIANCE AND ENFORCEMENT				
a. Monit. Results - No. of Tests				
1. Chem. Specific	N/A	N/A	N/A	N/A
2. Tox. - Acute	N/A	N/A	N/A	N/A
- Chronic	N/A	N/A	N/A	N/A
3. Rec. Body Biology	N/A	N/A	N/A	N/A
4. Bioaccumulation	N/A	N/A	N/A	N/A
5. Genotoxicity	N/A	N/A	N/A	N/A
Monit. Results - No. Violations				
1. Chem. Specific	N/A	N/A	N/A	N/A
2. Tox. - Acute	N/A	N/A	N/A	N/A
- Chronic	N/A	N/A	N/A	N/A
3. Rec. Body Biology	N/A	N/A	N/A	N/A
4. Bioaccumulation	N/A	N/A	N/A	N/A
5. Genotoxicity	N/A	N/A	N/A	N/A
b. Enforcement Activities - Number				
1. Prosecution	N/A	N/A	N/A	N/A
2. TRE	N/A	N/A	N/A	N/A
3. Other	N/A	N/A	N/A	N/A
Enforcement Act. - Outcome				
1. Prosecution	N/A	N/A	N/A	N/A
2. TRE	N/A	N/A	N/A	N/A
3. Other	N/A	N/A	N/A	N/A
7. OPINIONS OF INTERVIEWEE				
Major Strengths of Pres. Appr.	N/R	N/R	N/R	N/R
Mod. Req. to Improve System	N/R	N/R	N/R	N/R
Accept. of Effl. Control Progr.	N/R	N/R	N/R	N/R
1. By Industry	N/R	N/R	N/R	N/R
2. By Public	N/R	N/R	N/R	N/R
Number of Years Involved	N/R	N/R	N/R	N/R
INTERVIEWER	N/R	N/R	N/R	N/R
AFFILIATION	N/R	N/R	N/R	N/R
DATE	N/R	N/R	N/R	N/R
INTERVIEW #	N/R	N/R	N/R	N/R
INTERVIEWEE NAME	N/R	N/R	N/R	N/R
TITLE	N/R	N/R	N/R	N/R
ORGANIZATION	N/R	N/R	N/R	N/R
TELEPHONE NUMBER	N/R	N/R	N/R	N/R
Copy of Permit Secured	partial	partial	partial	partial
Other Information Received				
Accuracy	N/A	N/A	N/A	N/A

D.5 EXCERPTS FROM CASE STUDY PERMITS

NJ 1

EXCERPTS FROM

PERMIT NO. NJ 0004120

1.B EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning EDP and lasting through EDP + 5 years the permittee is authorized to discharge from outfall(s) serial number(s):003. There shall be no discharge of floating solids or visible foam in other than trace amounts. Samples taken in compliance with the specified monitoring requirements shall be taken at the following location(s): at the outfall of DSN 003 (Treatment Plant Effluent); and shall be reported monthly.

EFFLUENT CHARACTERISTIC	DISCHARGE LIMITATIONS			MONITORING REQUIREMENTS	
	Minimum	Average	Maximum	Frequency	Sample type
Flow (mgd)	N/A	N/A	N/A	Continuous	
pH (Standard Units)	6.0	N/A	9.0	Continuous	
Oil & Grease (mg/l)	N/A	10	15	Monthly	Grab
BOD5 Percent Reduction	N/A	85	N/A	2/Week	Calculated
Lead (kg/d)	N/A	1.4	3.1	2/Week	Composite
Zinc (kg/d)	N/A	13.2	23.3	2/Week	Composite
Mercury (kg/d)	N/A	0.23	0.27	2/Week	Composite
Chlorinated Hydrocarbons(kg/d)	N/A	1.5	4.6	2/Week	Composite
Nitrobenzene (kg/d)	N/A	4.4	25.3	2/Week	Composite
Toluene (kg/d)	N/A	2.80	6.57	2/Week	Grab
2-Chlorophenol (kg/d)	N/A	0.83	2.19	2/Week	Composite
Bis(2-Chloroethoxy)Methane (kg/d)	N/A	1.57	6.13	2/Week	Composite
Chlorobenzene (kg/d)	N/A	N/A	1.46	Monthly	Grab

1.B EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS (Continued)

During the period beginning EDP and lasting through EDP + 5 years the permittee is authorized to discharge from outfall(s) serial number(s):003

EFFLUENT CHARACTERISTIC	DISCHARGE LIMITATIONS			MONITORING REQUIREMENTS	
	Minimum	Average	Maximum	Frequency	Sample type
Benzene (kg/d)	N/A	N/A	1.46	Monthly	Grab
1,2-Dichlorobenzene (kg/d)	N/A	N/A	1.46	Monthly	Composite
1,3-Dichlorobenzene (kg/d)	N/A	N/A	1.46	Monthly	Composite
1,4-Dichlorobenzene (kg/d)	N/A	N/A	1.46	Monthly	Composite
1,2,4-Trichlorobenzene (kg/d)	N/A	N/A	1.46	Monthly	Composite
1,2-Trans-Dichloroethylene (kg/d)	N/A	N/A	1.46	Monthly	Composite
Ethylbenzene (kg/d)	N/A	N/A	1.46	Monthly	Grab
Naphthalene (kg/d)	N/A	N/A	1.46	Monthly	Composite
Tetrachloroethylene (kg/d)	N/A	N/A	1.46	Monthly	Grab
Trichloroethylene (kg/d)	N/A	N/A	1.46	Monthly	Grab
Priority Pollutants (except asbestos)	N/A	N/A	N/A	Monthly	Grab
Nitrogen Scan	N/A	N/A	N/A	Monthly	Grab
Mutagenicity (Ames Test)	N/A	N/A	N/A	Quarterly	See Part IV - B/C Pgs. 5-7 of 18

1.B EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS (Continued)

During the indicated periods the permittee is authorized to discharge from outfall serial number: 003

EFFLUENT CHARACTERISTIC	DISCHARGE LIMITATIONS			MONITORING REQUIREMENTS	
	Minimum	Average	Maximum	Frequency	Sample type
Biochemical Oxygen Demand BOD5 (kg/day)					
EDP thru EDP+2 yrs.	N/A	1886	3595	2/Week	Composite
EDP+2 yrs. thru EDP+5 yrs.	N/A	939	2412	2/Week	Composite
Total Suspended Solids (kg/day)					
EDP thru EDP+2 yrs.	N/A	3060	6895	2/Week	Composite
EDP+2 yrs. thru EDP+5 yrs.	N/A	1879	6895	2/Week	Composite
Total Organic Carbon (kg/day)					
EDP thru EDP+2 yrs.	N/A	4291	6815	2/Week	Composite
EDP+2 yrs. thru EDP+5 yrs.	N/A	3476	6815	2/Week	Composite
Chromium (kg/day)					
EDP thru EDP+1 yr.	N/A	16.0	37.0	2/Week	Composite
EDP+1 yr. thru EDP+5 yrs.	N/A	7.1	11.1	2/Week	Composite
Copper (kg/day)					
EDP thru EDP+1 yr.	N/A	16.0	43.2	2/Week	Composite
EDP+1 yr. thru EDP+5 yrs.	N/A	10.5	43.2	2/Week	Composite
Nickel (kg/day)					
EDP thru EDP+1 yr.	N/A	10.3	24.8	2/Week	Composite
EDP+1 yr. thru EDP+5 yrs.	N/A	1.57	5.84	2/Week	Composite
Toxicity (Bioassay)					
EDP thru EDP+ 6 months	96-hour LC50 > 5% (by volume)			Monthly	See
EDP+ 6 mos. thru EDP+18 mos.	96-hour LC50 $\geq$ 10% (by volume)			Monthly	Part IV-B/C
EDP+18 mos. thru EDP+36 mos.	96-hour LC50 $\geq$ 20% (by volume)			Monthly	Pages 2-4
EDP+36 mos. thru EDP+60 mos.	96-hour LC50 $\geq$ 50% (by volume)			2/Month	

2. TOXICITY LIMITATIONS AND BIOMONITORING REQUIREMENTS

A. Toxicity Limitations

1. An interim toxicity limit of a 96-hour LC50 $\geq$ 5% (by volume) shall become effective on EDP and last through EDP plus 6 months, an interim toxicity limit of a 96-hour LC50 $\geq$ 10% (by volume) shall become effective on EDP plus 6 months and last through EDP plus 18 months, and an interim toxicity limit of a 96-hour LC50 $\geq$ 20% (by volume) shall become effective on EDP plus 18 months and last through EDP plus 36 months, unless modified by the NJDEP based upon the results of the bioassays submitted to NJDEP.

2. The permittee shall conduct an effluent toxicity reduction study and submit to the NJDEP by EDP plus one year, a detailed toxicity reduction program identifying what specific measures will be implemented to achieve the final toxicity limit set forth in A.3. The permittee shall submit to NJDEP quarterly reports detailing the progress of the toxicity reduction study. The progress reports shall identify and quantify the toxic pollutants that will be reduced both through in-plant measures and through wastewater treatment.

3. A toxicity limit of a 96-hour LC50 $\geq$ 50% (by volume) shall become effective on EDP plus three years and last through the permit expiration date, unless modified by the NJDEP.

B. Biomonitoring Requirements

The permittee shall conduct 96-hour definitive flow-through or definitive modified static renewal acute bioassay tests on its wastewater discharge at a frequency of one per month from EDP through EDP + 3 years and two per month from EDP + 3 years through EDP + 5 years . The first bioassay test shall be initiated no later than one month from EDP, unless otherwise specified by the NJDEP.

1. All bioassays shall be conducted in accordance with the following procedures:

(a) Bioassay procedure shall conform to the "Regulations Governing Laboratory Certification and Standards of Performance" (N.J.A.C. 7:18). Subchapter 6 of the regulations contains the criteria and procedures for bioassay testing and analysis. The laboratory performing your bioassay testing will have to be within the laboratory certification program included within those regulations.

(b) The bioassay shall provide a measure of acute toxicity as determined by the wastewater concentration which causes 50% mortality of the appropriate test organisms over a 96-hour period. Test results shall be expressed in terms of Lethal Concentration (LC) and reported as 96-hour LC-50 with confidence intervals.

(c) The test organism shall be the mysid shrimp, (Mysidopsis bahia), at a test temperature of $22^{\circ}C \pm 2^{\circ}C$.

2. The following information shall be submitted within one month from the Effective Date of Permit:

(a) An identification of the certified bioassay laboratory responsible for the conduct of the bioassay tests.

(b) A detailed description of the methodology to be utilized in the conduct of the tests, including equipment, retention time of the wastewater in the treatment plant, collection method of a representative effluent sample, and name and source of test organisms.

(c) A schematic diagram which depicts the location that the effluent samples will be taken; the diagram shall indicate the location of effluent sampling in relation to any wastewater treatment facilities and Discharge Serial No. 003.

3. If the results of the 96-hour bioassay indicate a mysid shrimp mortality of 15% or more in the controls or that a violation of the applicable limitation (A.1 or A.3) has occurred, the permittee shall conduct an additional 96-hour definitive bioassay no later than 10 days after completion of the above referenced test.

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EXCERPTS FROM
PERMIT NO. NJ 0005100

1.E EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning EDP and lasting through EDP + 3 years, the permittee is authorized to discharge from outfall serial number: 661. There shall be no discharge of floating solids or visible foam in other than trace amounts. Samples taken in compliance with the specified monitoring requirements shall be taken at the following locations: at the outfall of DSN 661 (DuPont designated SPOT 661) ; and shall be reported monthly.

EFFLUENT CHARACTERISTIC	NET DISCHARGE LIMITATIONS			MONITORING REQUIREMENTS	
	Minimum	Average	Maximum	Frequency	Sample type
FLOW - mgd	N/A	Report	Report	Continuous	N/A
pH - Standard Units	Report	N/A	Report	Daily	Grab
BOD5 - mg/l	N/A	N/A	N/A	Twice Weekly	24-hr Comp
BOD5 REDUCTION - percent	Report	87.5	Report	Twice Weekly	24-hr Comp
TOTAL SUSPENDED SOLIDS - mg/l	N/A	Report	Report	Weekly	24-hr Comp
DISSOLVED ORGANIC CARBON -mg/l	N/A	Report	Report	Weekly	24-hr Comp
AMMONIA-N - mg/l	N/A	Report	Report	Weekly	24-hr Comp
ORGANIC NITROGEN-N - mg/l	N/A	Report	Report	Weekly	24-hr Comp
MUTAGENICITY - Ames Test	N/A	N/A	N/A	Quarterly	See Part IV
ACUTE TOXICITY - % effluent	$LC50\geq50$	N/A	N/A	Monthly	See Part IV
CHRONIC TOXICITY - % effluent	Report	N/A	N/A	Quarterly	See Part IV
PRIORITY POLLUTANT SCAN	N/A	N/A	Report	Monthly	Comp/Grab
BENZENE - kg/day	N/A	4.53	14.5	Weekly	Grab
CARBON TETRACHLORIDE - kg/day	N/A	2.72	5.44	Weekly	Grab
CHLOROBENZENE - kg/day	N/A	4.53	12.7	Weekly	Grab
CHLOROETHANE - kg/day	N/A	20.8	57.1	Weekly	Grab
CHLOROFORM - kg/day	N/A	9.06	13.6	Weekly	Grab
1,2-DICHLOROETHANE - kg/day	N/A	18.1	27.2	Weekly	Grab
METHYL CHLORIDE - kg/day	N/A	Report	9.06	Weekly	Grab
METHYLENE CHLORIDE - kg/day	N/A	4.53	9.97	Weekly	Grab

1.E EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning EDP and lasting through EDP + 3 years, the permittee is authorized to discharge from outfall serial number: 661. There shall be no discharge of floating solids or visible foam in other than trace amounts. Samples taken in compliance with the specified monitoring requirements shall be taken at the following locations: at the outfall of DSN 661 (DuPont designated SPOT 661) ; and shall be reported monthly.

EFFLUENT CHARACTERISTIC	NET DISCHARGE LIMITATIONS			MONITORING REQUIREMENTS	
	Minimum	Average	Maximum	Frequency	Sample type
TETRACHLOROETHYLENE - kg/day	N/A	4.53	11.8	Weekly	Grab
TOLUENE - kg/day	N/A	5.44	18.1	Weekly	Grab
1,1,1-TRICHLOROETHANE - kg/day	N/A	Report	9.06	Weekly	Grab
1,1,2-TRICHLOROETHANE - kg/day	N/A	9.06	13.6	Weekly	Grab
TRICHLOROETHYLENE - kg/day	N/A	4.53	11.8	Weekly	Grab
2-CHLOROPHENOL	N/A	6.34	22.7	Weekly	24-hr Comp
2,4-DICHLOROPHENOL - kg/day	N/A	8.15	23.6	Weekly	24-hr Comp
2,4-DIMETHYLPHENOL - kg/day	N/A	3.62	6.34	Weekly	24-hr Comp
4,6-DINITRO-O-CRESOL - kg/day	N/A	5.44	9.06	Weekly	24-hr Comp
2,4-DINITROPHENOL - kg/day	N/A	13.6	23.6	Weekly	24-hr Comp
2-NITROPHENOL - kg/day	N/A	5.44	9.06	Weekly	24-hr Comp
4-NITROPHENOL	N/A	12.7	21.7	Weekly	24-hr Comp
PENTACHLOROPHENOL - kg/day	N/A	11.8	18.1	Weekly	24-hr Comp
PHENOL -kg/day	N/A	Report	9.06	Weekly	24-hr Comp
ANTHRACENE - kg/day	N/A	6.34	19.0	Weekly	24-hr Comp
BIS(2-ETHYLHEXYL)PHTHALATE -	kg/day	8.15	23.6	Weekly	24-hr Comp
BUTYL BENZYL PHTHALATE - kg/d	N/A	Report	Report	Weekly	24-hr Comp
1,2-DICHLOROBENZENE - kg/day	N/A	22.7	45.3	Weekly	24-hr Comp
DI-N-BUTYL PHTHALATE - kg/day	N/A	7.25	14.5	Weekly	24-hr Comp
2,4-DINITROTOLUENE - kg/day	N/A	27.2	46.2	Weekly	24-hr Comp

1.E EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

During the period beginning EDP and lasting through EDP + 3 years, the permittee is authorized to discharge from outfall serial number: 661. There shall be no discharge of floating solids or visible foam in other than trace amounts. Samples taken in compliance with the specified monitoring requirements shall be taken at the following locations: at the outfall of DSN 661 (DuPont designated SPOT 661) ; and shall be reported monthly.

EFFLUENT CHARACTERISTIC	NET DISCHARGE LIMITATIONS			MONITORING REQUIREMENTS	
	Minimum	Average	Maximum	Frequency	Sample type
2,6-DINITROTOLUENE - kg/day	N/A	51.6	82.4	Weekly	24-hr Comp
DI-N-OCTAL PHTHALATE - kg/day	N/A	Report	Report	Weekly	24-hr Comp
FLUORENE - kg/day	N/A	6.34	19.0	Weekly	24-hr Comp
HEXACHLOROETHANE - kg/day	N/A	3.62	9.06	Weekly	24-hr Comp
ISOPHORONE - kg/day	N/A	Report	9.06	Weekly	24-hr Comp
NAPHTHALENE - kg/day	N/A	6.34	19.0	Weekly	24-hr Comp
NITROBENZENE - kg/day	N/A	51.6	87.0	Weekly	24-hr Comp
PHENANTHRENE - kg/day	N/A	6.34	19.0	Weekly	24-hr Comp
PYRENE - kg/day	N/A	7.24	24.5	Weekly	24-hr Comp
1,2,4-TRICHLOROBENZENE-kg/day	N/A	8.15	16.3	Weekly	24-hr Comp

BEST MANAGEMENT PRACTICES (BMP) REQUIREMENTS

In order to prevent, or minimize the potential for the release of toxic substances from ancillary activities to the waters of the United States through plant runoff, spillage or leaks, sludge or waste disposal or drainage from raw material storage, the permittee shall develop and implement a Best Management Practices (BMP) Plan.

These conditions apply to all permittees who use, manufacture, store, handle or discharge any pollutant listed as toxic under Section 307 (a)(1) of the Clean Water Act and who have ancillary manufacturing operations which could result in significant amounts of these pollutants reaching waters of the United States. These operations include material handling areas; plant site runoff; in-plant transfer, process and material handling areas; loading and unloading operations, and sludge and waste disposal areas.

The BMP Plan shall be consistent with the general guidance contained in the publication entitled "NPDES Best Management Practices Guidance Document," dated June 1981, and prepared by the U.S. Environmental Protection Agency, Office of Water Enforcement and Permits, NPDES Technical Support Branch. As a minimum, the plant shall include the following BMP's:

a. BMP Committee
b. Reporting of BMP Incidents
c. Risk Identification and Assessment
d. Employee Training
e. Inspections and Records
f. Preventive Maintenance
g. Good Housekeeping
h. Materials Compatibility
i. Security

The facility shall incorporate in the BMP Plan any appropriate procedures for adequately controlling spills and leaks of hazardous substances as specified in the DPCC Plan or other preventive plans submitted to the NJDEP. If, in the judgment of the BMP Committee, the present practices identified in these plans are adequate, they may be incorporated into the BMP Plan by reference.

TOXICITY LIMITATIONS AND BIOMONITORING REQUIREMENTS

1. Toxicity Limitations

a. An interim whole effluent acute toxicity limitation of a 96-hour LC50 $\geq$ 50% shall be in effect for DSN 661 on the Effective Date of the Permit (EDP) and remain in effect until the expiration date of the permit unless modified by the Department after examination of the permittee's determination of the Critical Instream Waste Concentration (I) for the Delaware River as discussed in N.J.A.C. 7:9-4.6(c) 5iii(2).

b. The permittee shall submit a plan of study for determination of the Critical Instream Waste Concentration (I) within 3 months of EDP. The permittee shall utilize scientifically defensible methods (i.e. plume modeling, dye studies, etc.) for determining I. Analysis shall be conducted for period(s) of maximum stratification, MA7CD10 flows, and any other critical periods. The study shall be completed and a final report submitted to NJDEP by EDP + 1 1/2 years.

c. The information requested in b, above shall be submitted to:

Bureau of Industrial Waste Management
Division of Water Resources
CN-029
Trenton, New Jersey 08625

Bureau of Water Quality Standards and Analysis
Division of Water Resources
CN-029
Trenton, New Jersey 08625

2. Acute Toxicity

The permittee shall conduct 96-hour definitive flow-through or definitive modified static renewal bioassay tests, of its wastewater discharge (DSN 661, DuPont designated Spot 661) at a frequency of one test every month. The first bioassay test shall be initiated no later than three months from EDP, unless otherwise specified by the NJDEP.

A. All bioassays shall be conducted in accordance with the following procedures:

(1) Bioassay procedure shall conform to the "Regulations Governing Laboratory Certification and Standards of Performance" (N.J.A.C. 7:18). Subchapter 6 of the regulations contains the criteria and procedures for bioassay testing and analysis. The laboratory performing your bioassay testing will have to be within the laboratory certification program.

(2) The bioassay shall provide a measure of acute toxicity as determined by the wastewater concentration which causes 50% mortality of the appropriate test organisms over a 96-hour period. Test results shall be expressed in terms of Lethal Concentration (LC) and reported as 96-hour LC-50.

(3) When the Delaware River has a tested salinity of less than or equal to 1 ppt., Fathead minnow fry (Pimephales promelas) shall be used. When the Delaware River has a tested salinity greater than 1 ppt., sheepshead minnow fry (Cyprinodon variegatus) shall be used. The test temperature shall be 22°C ± 2°C.

B. The following information shall be submitted within two months from the Effective Date of Permit:

(1) An identification of the certified bioassay laboratory responsible for the conduct of the bioassay tests.

(2) A detailed description of the methodology to be utilized in the conduct of the tests, including equipment, retention time of the wastewater in the treatment plant, collection method of a representative effluent sample, and name and source of test organisms.

(3) A schematic diagram which depicts the location that the effluent samples will be taken; the diagram shall indicate the location of effluent sampling in relation to any wastewater treatment facilities and Discharge Serial Nos.

C. If the results of the 96-hour bioassay indicate a mortality greater than or equal to 10% in the control, the permittee shall conduct an additional 96-hour bioassay, in replicate, no later than 10 days after completion of the above referenced test.

D. Bioassay results shall be reported on a form provided and shall be submitted within 60 days after completion of the tests. Results shall also be reported on the permittee's Discharge Monitoring Reports (DMR).

E. The information requested (B1 through B3) and the bioassay test results (D) shall be submitted to:

Bureau of Permits Administration
Water Quality Management
Division of Water Resources
CN-029
Trenton, New Jersey 08625

Bureau of Water Quality Standards
and Analysis
Division of Water Resources
CN-029
Trenton, New Jersey 08625

3. Chronic Toxicity

The permittee shall conduct a seven-day, static daily renewal chronic toxicity test, with a minimum of two replicates, of its waste water discharge (DSN 661, DuPont Designated spot 661) to the Fathead minnow (Pimephales promelas), at a frequency of one test every three months. The first bioassay test shall be initiated no later than three months from EDP, unless otherwise specified by the NJDEP.

1. All testing shall be conducted in accordance with the following procedures:

   (a) Chronic testing shall be performed with Fathead minnow (Pimephales promelas) newly hatched larvae when the Delaware River has a measured salinity less than 2ppt. The test temperature shall be 25° ± 2° C.

(b) Procedures for performing Chronic Toxicity Bioassay Tests shall be in conformance with "Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms" (EPA/600/4-85/014, p. 28-41). The laboratory performing your bioassay testing will have to be certified for acute toxicity testing within the NJDEP laboratory certification program.

(c) The chronic toxicity test shall provide a measure of chronic toxicity as determined by the wastewater concentration which causes 1% mortality of the Fathead minnow over a 7-day period. Test results shall be expressed in terms of Lethal Concentration (LC) and reported along with 95% confidence limits as a 7-day LC1. A survival NOEC (No Observed Effect Concentration), LOEC (Lowest Observed Effect Concentration) and (ChV) Chronic Value shall also be calculated and reported.

(d) The chronic toxicity test shall also provide a measure of growth (increase in weight) of the larvae over a 7-day period. Test results shall be expressed in terms of the NOEC (No Observed Effect Concentration), LOEC (Lowest Observed Effect Concentration) and ChV (Chronic Value).

2. The following information shall be submitted within two months from the Effective Date of Permit.

   (a) An identification of the certified laboratory responsible for conducting the chronic toxicity tests.

   (b) A detailed description of the methodology to be utilized in the conduct of the tests, including equipment, retention time of the wastewater in the treatment plant, collection method of a representative effluent sample, name and source of test organism, and location and collection of dilution water.

   (c) A schematic diagram which depicts the location that the effluent samples will be taken; the diagram shall indicate the location of effluent sampling in relation to any wastewater treatment facilities and Discharge Serial Nos.

3. If the results of the seven-day Fathead minnow chronic bioassay indicate greater than or equal to 20% mortality in the control, or if the control mortality exceeds that of any test concentration, the permittee shall conduct an additional 7-day assay, with a minimum of two replicates, no later than 10 days after completion of the above referenced test.

4. Bioassay results shall be reported on a form provided and shall be submitted within 60 days after completion of the tests.

5. The information requested above shall be submitted to:

Bureau of Industrial Waste Management
Water Quality Management
Division of Water Resources
CN-029
Trenton, New Jersey 08625

Bureau of Water Quality Standards and Analysis
Division of Water Resources
CN-029
Trenton, New Jersey 08625

MUTAGENICITY TESTING

The permittee shall conduct Ames mutagenicity tests on 24-hour composite samples of its wastewater discharge (DSN661) at a frequency of once every 3 months. Samples shall be collected according to the procedure entitled "Industrial Effluent Sampling Procedures for Ames Mutagenicity Analyses." This methodology is available from NJDEP's Office of Science and Research (OSR). The permittee shall conduct direct Ames analyses of unextracted, unconcentrated wastewater as outlined below. If results from this direct testing are negative or marginal, the permittee shall conduct mutagenicity testing of extracted, concentrated wastewater as described below. If results from the direct testing of a wastewater sample are clearly positive, these are to be reported to the NJDEP and no further analyses of that sample is required.

The first assay shall be initiated no later than 3 months from the effective date of the permit, unless otherwise specified by the NJDEP.

A. All direct assays shall be in accordance with the following procedures:

   1. Wastewater samples shall be prepared for mutagenicity testing according to Section II.C. of "Environmental Water Sampling Processing Protocol #11 (1986)" or any current update of this protocol.

   2. Ames mutagenicity tests shall be conducted on the prepared wastewater samples according to Section II of OSR's "Ames Salmonella Mutagenicity Assay Protocol (1986)" or any current update. At a minimum, the assay shall be performed with 2 tester strains, TA98 and TA100, both with and without metabolic activation. All assay controls listed in this protocol must be performed and yield results acceptable to the NJDEP. Spontaneous and solvent control counts for TA98 must be between 15-75 per plate, and for TA100 between 60-220 per plate.

   3. Duplicate plate tests must be conducted at each of 5 nontoxic sample doses. As specified in the above protocol, doses up to 3 milliliters per plate must be assayed, unless cytotoxicity precludes this dosage range. All raw data must be reported, along

with clear graphical dose-response curves. Qualitative interpretations of results (negative, marginal, positive) are to be conducted as stated in the above protocol.

4. For positive mutagenicity results, the Ames assay results must be expressed in revertants per milliliter of wastewater. These measurements should be calculated according to Section 2 of the Data Analysis portion of the "Ames Salmonella Mutagenicity Assay Protocol (1986)".

B. All assays conducted on extracted, concentrated wastewater shall be in accordance with the following procedures:

1. Wastewater sample volumes of ten liters shall be extracted and concentrated according to "Environmental Water Sample Processing Protocol #11 (1986)" or any current update of this protocol. All wastewater samples must be concentrated to a minimum of 1000-fold according to this technique.

2. Ames mutagenicity tests shall be conducted on the wastewater extracts according to Section II of OSR's "Ames Salmonella Mutagenicity Assay Protocol (1986)" or any current update. At a minimum, the assay shall be performed with 2 tester strains, TA98 and TA100, both with and without metabolic activation. All assay controls listed in this protocol must be performed and yield results acceptable to the NJDEP. Spontaneous and solvent control counts for TA98 must be betwen 15-75 per plate, and for TA100 between 60-200 per plate.

3. Duplicate plate tests must be conducted at each of 5 nontoxic sample doses. Doses up to 1 mg extractable material per plate must be assayed, unless the total extractable material weight or cytotoxicity precludes this dosage range. All raw data must be reported, along with clear graphical dose-response curves. Qualitative interpretations of results (negative, marginal, positive) are to be conducted as stated in the above protocol.

4. For positive mutagenicity results, the Ames assay shall provide two measures of the level of this activity reported both in revertants per microgram of extracted material and in revertants per milliliter of wastewater. These measurements should be calculated according to Section 2 of the Data Analysis portion of the "Ames Salmonella Mutagenicity Assay Protocol (1986)".

C. The permittee shall develop a plan to evaluate the chemical constituents responsible for mutagenic activity in the discharge.

D. The following information shall be submitted within 2 months of the effective date of the permit:

1. Identification of the organization responsible for the conduct of the mutagenicity assay.

2. A detailed description of the methodology to be utilized in the conduct of the tests, including both wastewater sample processing and the mutagenicity assay.

3. A schematic diagram depicting the location where effluent samples will be taken. The diagram shall indicate the location of effluent sampling in relation to any wastewater treatment facilities and DSN 661.

E. The permittee shall summarize all Ames assay results at the end of each year in the forth quarterly report submitted to NJDEP.

F. The permittee must submit their Ames assay results to both:

NJDEP
Office of Science & Research
CN-409
Trenton, NJ 08625

NJDEP
Bureau of Industrial Waste Management
Division of Water Resources
CN-029
Trenton, NJ 08625

BIOMONITORING EVALUATION

The permittee shall investigate bioassay tests which will be appropriate for the evaluation of toxicity of its complex discharge (DSN 661). The evaluation of these tests shall be done by the permittee in addition to the Ames test and fish bioassays that are included in this permit in order to further characterize the toxicity of its discharge.

The permittee shall evaluate acute and chronic toxicity bioassay tests including;

1. a mammalian cell mutagenicity test, such as sister chromatid exchange or chromosome aberration.
2. bioassay test with reproductive and teratogenic end points including the Japanese Medaka assay and a Daphnia Chronic toxicity test.

The permittee shall submit study proposals for the above within three months following the effective date of this permit. Bioassay evaluation studies will begin, with DEP approval, six months from the effective date of this permit with progress reports to be submitted quarterly. As the result of these studies NJDEP will select the most appropriate test(s) for this discharge. The permittee will conduct selected test(s) on its wastewater discharge as appropriate at a frequency to be determined by DEP.

In addition the permittee shall design and submit with its permit renewal application (EDP + 2 1/2 years) a biomonitoring study proposal to measure the structure and function of the aquatic community in the receiving waters affected by its wastewater discharges as delineated by the discharge dispersion study. The proposal shall address measurements of species population, community composition, diversity, morphometric development, reproductivity and physiological sublethal parameters, as well as performing in situ or in vitro bioassays using aquatic organisms representative of the Delaware River estuary.

NC 1

EXCERPTS FROM
PERMIT NO. NC 0005321

F. Toxicity Reopener

This permit shall be modified, or revoked and reissued to incorporate toxicity limitations and monitoring requirements in the event toxicity testing or other studies conducted on the effluent or receiving stream indicate that detrimental effects may be expected in the receiving stream as a result of this discharge.

G. The permittee shall conduct chronic toxicity tests on a quarterly basis using protocols defined in EPA Document 600/4-85/014 entitled "Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms". The testing shall be performed as a Ceriodaphnia Survival and Reproduction Test. Effluent collection will be performed twice during each test as 24 hour composite samples. Toxicity test exposure using the first composite sample will include the first three full days of testing. Exposure to the second composite sample will include the last four full days of testing. Effluent samples will be taken immediately prior to disinfection, but after all other treatment processes. The Chronic Value (ChV) must be greater than 1.7%. There will be minimally five effluent concentrations and a control exposure treatment. One effluent concentration shall equal 1.7%, which represents the instream waste concentation (I.W.C.) during 7Q10 low flow conditions and daily permitted discharge volume. The remaining concentrations shall be 0.5, 1, 3.5 and 95%. There may not be more than 20% mortality in at least 95% effluent after 48 hours of exposure.

Note: Failure to achieve test conditions as specified in the cited document, such as minimum control organism survival and appropriate environmental controls, shall constitute an invalid test and will require immediate retesting. Failure to submit suitable test results will constitute a permit violation.

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NC 2

EXCERPTS FROM

PERMIT NO. NC 0025135

A. (1). EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS Final

During the period beginningon the effective date of the Permit and lasting until expiration, the permittee is authorized to discharge from outfall(s) serial number(s). 001. Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristics	Discharge Limitations				Monitoring Requirements		
	~~Kg/day~~ (lbs/day)		Other Units (Specify)				
	Daily Avg.	Daily Max.	Daily Avg.	Daily Max.	Measurement Frequency	***Sample Type	*Sample Location
Flow			0.11 MGD		Continuous	Recording	I or E
BOD, 5Day,20^{o}C	61	123			Dialy	Composite	E
TSS	267	534			Daily	Composite	E
Fecal Coliform (geometric mean)			1000/100 ml	2000/100 ml	Daily	Grab	E,U,D
Dissolved Oxygen (minimum)			5.0 mg/l	5.0 mg/l	Daily	Grab	E,U,D
COD	735	1470			Weekly	Composite	E
Phenols	0.001	0.002			Weekly	Composite	E,U,D
Sulfides	2.45	4.9			Weekly	Composite	E
Total Chromium	0.072	0.108			Weekly	Composite	E,U,D
LC 50**			>90%	>90%	Quarterly	Composite	E
Total Nitrogen (NO_2 + NO_3 + TKN)					Quarterly	Composite	E
Total Phosphorus					Quarterly	Composite	E
Temperature			****		Daily	Grab	E,U,D
BOD_{ult}					Quarterly	Composite	E
Zinc					2/Month	Composite	E
Copper					2/Month	Composite	E

*Sample locations: E - Effluent, I - Influent, U - Upstream, D - Downstream

**See Part III, Condition No. F. of this permit.

***All stream samples shall be grab samples.

****The temperatur of the effluent shall be such that it will not cause a temperature in the receiving stream of 2.8 C above the ambient stream water temperature and in no case exceed 29^{o}C.

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The pH shall not be less than 6.0 standard units nor greater than 9.0 standard units and shall be monitored daily at the effluent by grab sample.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

F. "Toxicity bioassay tests are to be conducted on the effluent at a point prior to entrance to the receiving waters either prior to chlorination or with chlorine removed from the test sample. The effluent samples are to be a 24 hour composite. Toxicity testing should employ either Daphnia pulex or Pimephelas promelas as the test species. The test method shall be 48 hour static or static renewal bioassays as described in Peltier, W. 1978. Methods for Measuring the Acute Toxicity of Effluents to Aquatic Organisms, 2nd Edition, Environmental Monitoring and Support Laboratory, U.S. EPA, Cincinnati, Ohio; July, 1978; EPA 600/4-78-012. The test results should be submitted to the Division of Environmental Management within 30 days following completion of these tests. If the resulting LC50 value, for the individual quarterly tests, is not greater than 90%, the test is to be conducted again within 30 days of the previous tests and thus repeated every 30 days until compliance is attained.

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NC 3

EXCERPTS FROM

PERMIT NO. NC 0026646

A. (1). EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS FINAL WINTER (NOVEMBER 1 - MARCH 31)

During the period beginning on the effective date of the Permit **and lasting until** expiration **the permittee is authorized to discharge from outfall(s) serial number(s)** 001. **Such discharges shall be limited and monitored by the permittee as specified below:**

Effluent Characteristics	Discharge Limitations				Monitoring Requirements		
	Kg/day (lbs/day)		Other Units (Specify)				
	Monthly Avg.	Weekly Avg.	Monthly Avg.	Weekly Avg.	Measurement Frequency	Sample Type	Sample Location
Flow			1.5 MGD		Continuous	Recording	I or E
BOD, 5Day, 20°C ***			30.0 mg/l	45.0 mg/l	Daily	Composite	E, I
Total Suspended Residue***			30.0 mg/l	45.0 mg/l	Daily	Composite	E, I
NH_3 as N					Daily	Composite	E
Dissolved Oxygen (minimum)			5.0 mg/l	5.0 mg/l	Daily	Grab	E,U,D
Fecal Coliform (geometric mean)			1000.0/100 ml.	2000.0/100 ml.	Daily	Grab	E,U,D
Residual Chlorine					Daily	Grab	E
Temperature			**	**	Daily	Grab	E,U,D
Total Nitrogen					Monthly	Composite	E
Total Phosphorus					Monthly	Composite	E
Zinc					Monthly (1)	Composite	E
Copper					Monthly (1)	Composite	E
Toxicity ****					Quarterly	Composite	E

(1) Monthly samples, in this case, shall be taken on a Wednesday, Thursday or Friday.

* Sample locations: E - Effluent, I - Influent, U - Upstream, D - Downstream.

** The temperature of the effluent shall be such as not to cause an increase in the temperature of the receiving stream of more than 2.8°C and in no case cause the ambient water temperature to exceed 29°C.

***The monthly average effluent BOD_5 and Total Suspended Residue concentrations shall not exceed 15% of the respective influent values (85% Removal).

****See Part III, Paragraph No. 1.

Upstream and downstream samples shall be grab samples.

Stream samples shall be collected three times per week during June, July, August and September and once per week during the remaining months of the year.

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The pH shall not be less than 6.0 **standard units nor greater than** 9.0 **standard units and shall be monitored** daily at the effluent by grab sample.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

A. (1). EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS FINAL SUMMER (APRIL 1 - OCTOBER 31)

During the period beginning on the effective date of the Permit **and lasting until** expiration **the permittee is authorized to discharge from outfall(s) serial number(s)** 001
Such discharges shall be limited and monitored by the permittee as specified below:

Effluent Characteristics	**Discharge Limitations**				**Monitoring Requirements**		
	Kg/day (lbs/day)		**Other Units (Specify)**				
	Monthly Avg.	**Weekly Avg.**	**Monthly Avg.**	**Weekly Avg.**	**Measurement Frequency**	**Sample Type**	* **Sample Location**
Flow			1.5 MGD		Continuous	Recording	I or E
BOD, 5Day, 20°C***			30.0 mg/l	45.0 mg/l	Daily	Composite	E,I
Total Suspended Residue***			30.0 mg/l	45.0 mg/l	Daily	Composite	E,I
NH_3 as N			14.0 mg/l	21.0 mg/l	Daily	Composite	E
Dissolved Oxygen (minimum)			5.0 mg/l	5.0 mg/l	Daily	Grab	E,U,D
Fecal Coliform (geometric mean)			1000.0/100 ml.	2000.0/100 ml.	Daily	Grab	E,U,D
Residual Chlorine					Daily	Grab	E
Temperature			**	**	Daily	Grab	E,U,D
Total Nitrogen ($NO_2 + NO_3$ + TKN)					Monthly	Composite	E
Total Phosphorus					Monthly	Composite	E
Zinc			0.05 mg/l	0.075 mg/l	Weekly (1)	Composite	E
Copper			0.015 mg/l	0.024 mg/l	Weekly (1)	Composite	E
Toxicity****					Quarterly	Composite	E

(1) Weekly samples, in this case, shall be taken on Wednesday, Thursday or Friday.

* Sample locations: E - Effluent, I - Influent, U - Upstream, D - Downstream

**The temperature of the effluent shall be such as not to cause an increase in the temperature of the receiving stream of more than 2.8°C and in no case cause the ambient water temperature to exceed 29°C.

***The monthly average effluent BOD_5 and Total Suspended Residue concentrations shall not exceed 15% of the respective influent values (85% Removal).

****See Part III, Paragraph No. 1.

Upstream and downstream samples shall be grab samples.

Stream samples shall be collected three times per week during June, July, August and September and once per week during the remaining months of the year.

The pH shall not be less than 6.0 **standard units nor greater than** 9.0 **standard units and shall be monitored** daily at the effluent by grab sample.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

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I. The permittee shall conduct chronic toxicity tests on a quarterly basis using protocols defined in EPA Document 600/4-85/014 entitled "Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms". The testing shall be performed as a Ceriodaphnia Survival and Reproduction Test. Effluent collection will be performed twice during each test as 24 hour composite samples. Toxicity test exposure using the first composite sample will include the first three full days of testing. Exposure to the second composite sample will include the last four full days of testing. Effluent samples will be taken immediately prior to disinfection, but after all other treatment processes. The Chronic Value (ChV) must be greater than 94%. There will be minimally five effluent concentrations and a control exposure treatment. One effluent concentration shall equal 94%, which represents the instream waste concentation (I.W.C.) during 7Q10 low flow conditions and daily permitted discharge volume. The remaining concentrations shall be 6%, 12%, 23%, and 47%. There may not be more than 20% mortality in at least 94% effluent after 48 hours of exposure.

Note: Failure to achieve test conditions as specified in the cited document, such as minimum control organism survival and appropriate environmental controls, shall constitute an invalid test and will require immediate retesting. Failure to submit suitable test results will constitute a permit violation.

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NC 4

EXCERPTS FROM

PERMIT NO. NC 0021474

A. (1). EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS Final Winter: November 1 - March 31

During the period beginning on the effective date of the permit and lasting until expiration, permittee is authorized to discharge from outfall(s) serial number(s). 001
Such discharges shall be limited and monitored by the permittee as specified below:

fluent Characteristics	Discharge Limitations				Monitoring Requirements		
	Kg/day (lbs/day)		Other Units (Specify)				
	Daily Avg.	Daily Max.	Daily Avg.	Daily Max.	Measurement Frequency	Sample Type	* Sample Location
Flow			1.2 MGD		Continuous	Recording	I or E
BOD,5Day,20°C **			15.0 mg/l	22.5 mg/l	2/Month	Composite	E,I
Total Suspended Residue **			30.0 mg/l	45.0 mg/l	2/Month	Composite	E,I
NH_3 as N			9.0 mg/l	13.5 mg/l	2/Month	Composite	E
Dissolved Oxygen (minimum)			6.0 mg/l	6.0 mg/l	Weekly	Grab	E,U,D
Fecal Coliform (geometric mean)			1000.0/100 ml	2000.0/100 ml	2/Month	Grab	E,U,D
Residual Chlorine					Daily	Grab	E
Temperature					Weekly	Grab	E,U,D
Total Nitrogen (NO_2 + NO_3 + TKN)					Monthly	Composite	E
Total Phosphorus					Monthly	Composite	E
Cadmium			2.0 µg/l	2.0 µg/l	2/Month	Composite	E
Chromium			50.0 µg/l	50.0 µg/l	2/Month	Composite	E
Copper					Monthly	Composite	E
Mercury			0.2 µg/l	0.2 µg/l	2/Month	Composite	E
Zinc					Monthly	Composite	E
Toxicity ***							

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*Sample location: E - Effluent, I - Influent, U - Upstream, D - Downstream

**The monthly average effluent BOD_5 and Total Suspended Solids concentrations shall not exceed 15% of the respective influent values (85% removal).

***See Part III, Condition No. I.

The pH shall not be less than 6.0 **standard units nor greater than** 9.0 **standard units and shall be monitored** 2/Month at the effluent by grab sample.

A. (1). EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS Final Summer: April 1 - October 31

During the period beginning on the effective date of the permit **and lasting until** expiration, **the permittee is authorized to discharge from outfall(s) serial number(s)** 001 **Such discharges shall be limited and monitored by the permittee as specified below:**

Effluent Characteristics	Discharge Limitations				Monitoring Requirements		
	Kg/day (lbs/day)		Other Units (Specify)				
	Monthly Avg.	Weekly Avg.	Monthly Avg.	Weekly Avg.	Measurement Frequency	Sample Type	*Sample Location
Flow			1.2 MGD		Continuous	Recording	I or E
BOD,5Day,$20^{o}C$ **			11.0 mg/l	16.5 mg/l	2/Month	Composite	E,I
Total Suspended Residue **			30.0 mg/l	45.0 mg/l	2/Month	Composite	E,I
NH_3 as N			4.0 mg/l	6.0 mg/l	2/Month	Composite	E
Dissolved Oxygen (minimum)			6.0 mg/l	6.0 mg/l	Weekly	Grab	E,U,D
Fecal Coliform (geometric mean)			1000.0/100 ml	2000.0/100 ml	2/Month	Grab	E,U,D
Residual Chlorine					Daily	Grab	E
Temperature					Weekly	Grab	E,U,D
Total Nitrogen (NO_2 + NO_3 + TKN)					Monthly	Composite	E
Total Phosphorus					Monthly	Composite	E
Cadmium			2.0 µg/l	2.0 µg/l	2/Month	Composite	E
Chromium			50.0 µg/l	50.0 µg/l	2/Month	Composite	E
Copper					Monthly	Composite	E
Mercury			0.2 µg/l	0.2 µg/l	2/Month	Composite	E
Zinc					Monthly	Composite	E
Toxi[illegible]							

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*Sample locations: E - Effluent, I - Influent, U - Upstream, D - Downstream

**The monthly average effluent BOD_5 and Total Suspended Solids concentrations shall not exceed 15% of the respective influent values (85% removal).

***See Part III, Condition No. I.

The pH shall not be less than 6.0 **standard units nor greater than** 9.0 **standard units and shall be monitored** 2/Month at the effluent by grab sample.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

The permittee shall conduct chronic toxicity tests on a quarterly basis using protocols defined in EPA Document 600/4-85/014 entitled "Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms". The testing shall be performed as a Ceriodaphnia Survival and Reproduction Test. Effluent collection will be performed twice during each test as 24 hour composite samples. Toxicity test exposure using the first composite sample will include the first three full days of testing. Exposure to the second composite sample will include the last four full days of testing. Effluent samples will be taken immediately prior to disinfection, but after all other treatment processes. The Chronic Value (ChV) must be greater than 99%. There will be minimally five effluent concentrations and a control exposure treatment. One effluent concentration shall equal 99%, which represents the instream waste concentation (I.W.C.) during 7Q10 low flow conditions and daily permitted discharge volume. The remaining concentrations shall be 12%, 25%, 50%, and 75%. There may not be more than 10% mortality in at least 99% effluent after 48 hours of exposure.

Note: Failure tc achieve test conditions as specified in the cited document, such as minimum control organism survival and appropriate environmental controls, shall constitute an invalid test and will require immediate retesting. Failure to submit suitable test results will constitute a permit violation.

J. Other Requirements

1. The permittee will be required at all times to operate facilities as efficiently as possible and in a manner which will minimize discharges of excessive pollutants.

2. The permittee shall provide an adequate operating staff which is duly qualified to carry out the operation, maintenance, and testing functions required to ensure compliance with the conditions specified in the permit.

3. Maintenance of treatment facilities that result in degradation of effluent quality shall be scheduled during non-critical water quality periods and shall be carried out in a manner approved by the State.

K. Nutrient Control

This permit may be modified, or revoked and reissued for inclusion of an effluent limitation on nutrients for this discharge depending upon the following:

1. The findings of a study by the Division of Environmental Management determine nutrient control is necessary.

2. Local actions do not successfully reduce the nutrient loading on the receiving waters.

3. The onset of problem conditions in the receiving waters.

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M 1

EXCERPTS FROM

PERMIT NO. MI 0000825

2. Final Effluent Limitations

During the period beginning on September 1, 1986 and lasting until the expiration of this permit, the permittee is authorized to discharge an average of two hundred fifty thousand (250,000) gallons per day* of treated process wastewater and rinse waters from outfall 001 to Swan Creek via County Drain #30. Such discharge shall be limited and monitored by the permittee as specified below:

	Discharge Limitations *****				Monitoring Requirements	
	kg/day (lbs/day)		Other Limitations			
Effluent Characteristic	Monthly Average	Daily Maximum	Monthly Average	Daily Maximum	Measurement Frequency	Sample Type
Flow, M^3/Day (MGD)					Daily	Report total daily flow
Total Suspended Solids	24(52)	33(73)	25 mg/l	35 mg/l	Twice Weekly	24-Hr. Composi
Total Nickel	0.41(0.90)	1.4(3.2)	430 ug/l	1530 ug/l	Daily	24-Hr. Composi
Total Copper	0.13(0.29)	0.24(0.52)	140 ug/l	250 ug/l	Daily	24-Hr. Composi
Total Chromium	0.31(0.69)	0.74(1.6)	330 ug/l	780 ug/l	Daily	24-Hr. Composi
Hexavalent Chromium	0.017(0.038)	0.063(0.14)	18 ug/l	67 ug/l	Daily	24-Hr. Composi
Total Toxic Organics **				2.13 mg/l***	****	****

*The flow volume is not to be considered as a limitation.

**See Part I-A-3 for definition of TTO.

***This is a guideline based limitation. The discharge of toxic organic compounds at levels which would violate Section 6(a) of Act 245 is prohibited.

****The permittee shall select one of the two alternatives for determining compliance with the daily maximum TTO limit of 2.13 mg/l.

Alternative No. 1. - Monitoring of those TTO's reasonably expected to be present in the discharge. The pollutants analyzed, the frequency of analysis, duration of monitoring, sample type, sample location, and test procedures shall be approved by the Chief of the Surface Water Quality Division.

Alternative No. 2. - Instead of monitoring for TTO, the permittee shall carry-out the requirements for the toxic organic pollutant management plan and certification statement as specified in Part I, A-4.

Within 30 days after the date of issuance of this permit, the permittee shall provide written notification to the Chief of the Surface Water Quality Division of the alternative selected.

*****In accordance with the Commission's rules, the permittee may demonstrate that these limitations are more restrictive than necessary and may seek a modification of this permit.

Part I-A-2 (continued)

a. The pH shall not be less than 6.0 nor greater than 9.0. The pH shall be monitored as follows: continuous; report daily maximum and minimum.

The permittee is allowed pH excursions up to pH 10.5 and down to pH 5.5 provided that these excursions do not exceed 7 hours and 26 minutes in any calendar month, and any individual excursion shall not exceed 60 minutes in duration.

b. The discharge shall not cause excessive foam in the receiving waters. The discharge shall be essentially free of floating and settleable solids.

c. The discharge shall not contain oil or other substances in amounts sufficient to create a visible film or sheen on the receiving waters.

d. Samples taken in compliance with the monitoring requirements above shall be taken prior to discharge to County Drain #30.

e. In the event the permittee shall require the use of water treatment additives which would be discharged into the facility's effluent in addition to Watcon 0128, Watcon 1437, Watcon 1262, Polymer DWT 3000A, Polyfloc MP, sulfuric acid, hydrochloric acid, nitric acid, sodium hydroxide, lime, soda ash, calcium chloride, calcium carbonate, sodium hydrosulfite, sodium bisulfite, sodium sulfide, ferrous sulfate, sodium metabisulfite, sodium sulfite, and ferrous chloride, the permittee shall notify the Chief of the Surface Water Quality Division at least 20 working days prior to such use, in accordance with the requirements of Part II, Section A.2. An additive shall not be used if the permittee is notified by the Chief of the Surface Water Quality Division that its use is not acceptable, and the reasons for that determination.

For the purposes of this provision, the term "water treatment additives" shall mean materials added to process wastewater to effect wastewater treatment, or materials added to the boilers' influent water supply, and shall not include chemicals, materials, or substances used in the electroplating process itself.

3. Total Toxic Organics (definition) - The term "TTO" shall mean total toxic organics which is the summation of all quantifiable values greater than .01 milligrams per liter for the following toxic organics:*

Acenaphthene
Acrolein
Acrylonitrile
Benzene
Benzidine
Carbon tetrachloride (tetrachloromethane)
Chlorobenzene
1,2,4-trichlorobenzene
Hexachlorobenzene
1,2-dichloroethane
1,1,1-trichloroethane
Hexachloroethane
1,1-dichloroethane
1,1,2-trichloroethane
1,1,2,2-tetrachloroethane
Chloroethane
Bis (2-chloroethyl) ether
2-chloroethyl vinyl ether (mixed)
2-chloronaphthalene
2,4,6-trichlorophenol
Parachlorometa cresol
Chloroform (trichloromethane)
2-chlorophenol
1,2-dichlorobenzene
1,3-dichlorobenzene
1,4-dichlorobenzene
3,3-dichlorobenzindine
1,1-dichloroethylene
1,2-trans-dichloroethylene
2,4-dichlorophenol
1,2-dichloropropane (1,3-dichloropropene)
2,4-dimethylphenol
2,4-dinitrotoluene
2,6-dinitrotoluene
1,2-diphenylhydrazine
Ethylbenzene
Fluoranthene
4-chlorophenyl phenyl ether
4-bromophenyl phenyl ether
Bis (2-chloroisopropyl) ether
Bis (2-chloroethoxy) methane
Methylene chloride (dichloromethane)
Methyl chloride (chloromethane)
Methyl bromide (bromomethane)
Bromoform (tribromomethane)
Dichlorobromomethane
Chlorodibromomethane
Hexachlorobutadiene
Hexachlorocyclopentadiene
Isophorone
Naphthalene
Nitrobenzene
2-nitrophenol
4-nitrophenol
2,4-dinitrophenol
4,6-dinitro-o-cresol
N-nitrosodimethylamine
N-nitrosodiphenylamine
N-nitrosodi-n-propylamine
Pentachlorophenol
Phenol
Bis (2-ethylhexyl) phthalate
Butyl benzyl phthalate
Di-n-butyl phthalate
Di-n-octyl phthalate
Diethyl phthalate
Dimethyl phthalate
1,2-benzanthracene (benzo(a)anthracene)
Benzo(a)pyrene(3,4-benzopyrene)
2,4-Benzofluoranthene (benzo(b)fluoranthene)
11,12-benzofluoranthene (benzo(k)fluoranthene)
Chrysene
Acenaphthylene
Anthracene
1,12-benzoperylene (benzo(ghi)perylene)
Fluorene
Phenanthrene
1,2,5,6-dibenzanthracene (dibenzo(a,h)anthracene)
Indeno(1,2,3-cd)pyrene (2,3-o-phenlene pyrene)
Pyrene
Tetrachloroethylene
Toluene
Trichloroethylene
Vinyl chloride (chloroethylene)
Aldrin
Dieldrin
Chlordane (technical mixture and metabolites)
4,4-DDT
4,4-DDE (p,p-DDX)
4,4-DDD (p,p-TDE)
Alpha-endosulfan
Beta-endosulfan
Endosulfan sulfate
Endrin
Endrin aldehyde
Heptachlor
Heptachlor epoxide (BHC- hexachlorocyclohexane)
    Alpha-BHC
    Beta-BHC
    Gamma-BHC
    Delta-BHC
PCB-polychlorinated biphenyls
    PCB-1242 (Arochlor 1242)
    PCB-1254 (Arochlor 1254)
    PCB-1221 (Arochlor 1221)
    PCB-1232 (Arochlor 1232)
    PCB-1248 (Arochlor 1248)
    PCB-1260 (Arochlor 1260)
    PCB-1016 (Arochlor 1016)
Toxaphene
2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD)

*The Total Toxic Organics shall be analyzed using EPA Methods 624 and 625 from 40 CFR, Part 136.

Part I-A

4. Alternative to TTO Monitoring

If the permittee selects "Alternative No. 2" (as specified on pages 2 & 4 of 13) to determine compliance with the maximum TTO limit of 2.13 mg/l, then the permittee shall submit and receive approval for a Toxic Organic Pollutant Management Plan as specified in Part I, C.3. of this permit. The plan shall specify the toxic organic chemicals used and sludges or process residuals generated; the method of disposal used, such as reclamation, contract hauling, or incineration; and procedures for ensuring that toxic organic pollutants do not spill or routinely leak into process wastewater, noncontact cooling water, groundwater, stormwaters, or other surface waters.

Any change in the Toxic Organic Pollutant Management Plan shall be approved by the Chief of the Surface Water Quality Division prior to its implementation by the permittee.

Upon approval of the Toxic Organic Pollutant Management Plan, the permittee shall submit the following certification on the Monthly Operating Reports:

> "Based on my inquiry of the person or persons directly responsible for managing compliance with the permit limitation for Total Toxic Organics, I certify that, to the best of my knowledge and belief, no dumping of concentrated toxic organics into the wastewaters has occurred since the period covered by the last monthly operating report. I further certify that this facility has implemented the approved Toxic Organic Pollutant Management Plan since the period covered by the last monthly operating report."

Part I-A

5. Special Condition - Short-Term Waste Characterization Study

As a condition of this permit, beginning upon issuance of this permit and before December 31, 1986, the permittee shall monitor* outfall 001 for the constituents, at the frequency, and for the period specified below. The results of the analysis of such monitoring shall be submitted by March 31, 1987, to the Chief of the Surface Water Quality Division. If, upon review of the analysis, it is determined that any of the materials or constituents require limiting either to protect the receiving waters in accordance with applicable Water Quality Standards, or to comply with applicable promulgated effluent limitation guidelines, the permittee will be so informed. The permit will then be modified in accordance with Part II, B-4.

CONSTITUENT	SAMPLE TYPE	SAMPLE FREQUENCY	SAMPLE DURATION
Ammonia (as N)	24-Hr. Composite	Once Weekly	8 weeks
$CBOD_5$	24-Hr. Composite	Once Weekly	8 weeks
Total Cadmium**	24-Hr. Composite	Once Weekly	4 weeks
Oil and Grease	24-Hr. Composite	Once Weekly	8 weeks

*The permittee shall submit a monitoring, sampling, and analysis plan to the Chief of the Surface Water Quality Division and receive approval thereof in accordance with Part I, C-4 Schedule of Compliance.

**A detection level of less than or equal to 0.5 ug/l is required.

M 2

EXCERPTS FROM
PERMIT NO. MI 0023299

PERMIT CONDITIONS

PART I

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS.

2. Final Effluent Limitations

a. During the period beginning January 1, 1986 and lasting until date of expiration the permittee is authorized to discharge treated municipal wastewaters from the Kalamazoo wastewater treatment plant through outfall 001 to the Kalamazoo River. Such discharges shall be limited and monitored by the permittee as follows:

EFFLUENT CHARACTERISTICS	DATES IN EFFECT	EFFLUENT LIMITATIONS				TESTING FREQUENCY
		Minimum	Maximums			
		Daily	Daily	30 Day Avg.	7 Day Avg.	
Carbonaceous 5-Day 20° C Biochemical Oxygen Demand	May 1 to Sept. 30	---	10 mg/l	7 mg/l 1408 kg/day 3112 lb/day	2011 kg/day 4445 lb/day	Daily
	Oct. 1 to Oct. 31	---	15 mg/l	10 mg/l 2011 kg/day 4445 lb/day	3017 kg/day 6668 lb/day	Daily
5-Day 20°C Biochemical Oxygen Demand	Nov. 1 to April 30	---	---	30 mg/l 6034 kg/day 13336 lb/day	45 mg/l 9051 kg/day 20003 lb/day	Daily
Ammonia Nitrogen (as N)(NH_3-N)	May 1 to Sept. 30	---	2.0 mg/l	---	402 kg/day 889 lb/day	Daily
	Oct. 1 to Oct. 31	---	10.0 mg/l	---	2011 kg/day 4445 lb/day	Daily
Suspended Solids	May 1 to Sept. 30	---	---	20 mg/l 4023 kg/day 8890 lb/day	30 mg/l 6034 kg/day 13336 lb/day	Daily
	Oct. 1 to April 30	---	---	30 mg/l 6034 kg/day 13336 lb/day	45 mg/l 9051 kg/day 20003 lb/day	Daily
pH	All Year	6.0	9.0	---	---	Daily
Dissolved Oxygen	All Year	4.0 mg/l	---	---	---	Daily
Fecal Coliform Bacteria	May 15 to Oct. 15	---	---	200/100 ml	400/100 ml	Daily
Total Phosphorus (as P)	All Year	---	---	1.0 mg/l 225 lb/day*	---	Daily
Total Residual Chlorine	All Year beginning 7-1-88	---	0.043 mg/l	---	---	Daily during periods of disinfection

The following design flows were used in determining the above limitations, but are not to be considered limitations or actual capacities themselves: Annual Average Design Flow of 53.3 MGD

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PERMIT CONDITIONS

PART I, Section A-2

EFFLUENT CHARACTERISTICS	DATES IN EFFECT	EFFLUENT LIMITATIONS				TESTING FREQUENCY
		Minimum	Maximums			
		Daily	Daily	30-Day Avg.	7-Day Avg.	
Total Cadmium	All Year	---	---	---	---	2 x monthly
	All Year beginning 1/1/88	---	15 ug/l	1.6 ug/l	---	2 x monthly
Total Lead	All Year	---	---	---	---	2 x monthly
	All Year beginning 1/1/88	---	114 ug/l	24 ug/l	---	2 x monthly
Total Silver	All Year	---	---	---	---	2 x monthly
	All Year beginning 1/1/88	---	0.8 ug/l	---	---	2 x monthly
Amenable Cyanide	All Year	---	---	---	---	2 x monthly
	All Year beginning 1/1/88	---	91 ug/l	10 ug/l	---	2 x monthly
1,2-dichloroethane	All Year	---	---	see h.	---	1 x quarterly

PART I, Section A-2

b. All samples shall be 24 hour composite samples taken prior to disinfection except Fecal Coliform Bacteria, Total Residual Chlorine, Dissolved Oxygen, and pH which shall be grab samples of the effluent.

c. The total daily effluent flow shall be measured daily.

d. During the period that Coliform Bacteria Limitations are in effect, the permittee shall provide adequate control and facilities to ensure continuous disinfection.

e. The carbonaceous BOD_5 limitation shall be considered as BOD_5 excluding the oxygen demand attributable to nitrification.

f. Variance Opportunity - Opportunity exists under the Provision of Rules of the Michigan Water Resources Commission (R 323.1082) to demonstrate to the Commission that the concentration of a material potentially toxic to fish or fish food organisms greater than the 96 hour TL_m (0.024 mg/l Total Residual Chlorine) is acceptable. The demonstration, if undertaken, shall conclusively demonstrate to the satisfaction of the Commission that such higher concentration will not cause an irreversible response which results in deleterious effects to populations of important aquatic life and wildlife, and interference with passage of fish and fish food organisms results only to the extent that impacts on their immediate and future populations are negligible or not measurable. Such a demonstration, if undertaken, shall be submitted to the Chief of the Surface Water Quality Division on or before September 1, 1986.

g. In addition to the BOD and Suspended Solids limitations above, the 30-day average effluent BOD and Suspended Solids concentrations shall not exceed 15 percent of the average influent concentrations for approximately the same period. This applies for the time period of November 1 through April 30.

*It is recognized that the City of Kalamazoo will be undertaking studies regarding the discharge of phosphorus from its wastewater treatment plant. The studies will include a program to identify the sources of phosphorus to the treatment plant, what phosphorus reductions are possible, and what resultant phosphorus reductions may be expected in the wastewater treatment plant effluent. In addition, the City of Kalamazoo will be studying the effects of its discharge on the Kalamazoo River with respect to nutrient loadings and resultant nuisance plant growths. Upon completion of the studies, the City of Kalamazoo will submit to the Chief of the Surface Water Quality Division a report which summarizes the findings of the studies. Following review of this new information, staff may recommend to the Water Resources Commission that the phosphorus limitation be revised and the permit modified accordingly.

PART I, Section A-2

h. The discharger shall notify the Chief of the Surface Water Quality Division in writing within 10 days of any discharge of 1,2 dichloroethane at or above the level of 200 ug/l. This parameter shall be monitored at least quarterly.

If the above notification level is exceeded, the permittee shall promptly commence, unless otherwise notified by the Chief of the Surface Water Quality Division, an investigation into the cause of the discharge. The investigation shall include weekly sampling for 6 weeks. A report shall be submitted to the Chief of the Surface Water Quality Division within 4 months of the notification date containing the 6 weeks of monitoring data, and the permittee's explanation as to the cause, steps taken to correct the situation, and the likelihood of reoccurrence of the discharge, and any modification to existing treatment and control.

i. Demonstration Opportunity Regarding Total Cadmium, Lead, Silver and Amenable Cyanide

The permittee may demonstrate to the Michigan Water Resources Commission that a total cadmium, lead, silver, or amendable cyanide limitation greater than the value listed in the final effluent limitations is acceptable under the Water Quality Standards. Such a demonstration may establish that: a) fish cannot physically inhabit the zone where concentrations of total cadmium, lead, silver, or amenable cyanide are greater than the listed limit, b) toxicity tests, using species and/or water more representative of the discharge point, result in a higher aquatic criteria, or c) other rationale warrants different final effluent limitations, including whole effluent toxicity based limitations.

The permittee shall notify the Michigan Water Resources Commission when a demonstration will be attempted. When a demonstration is to be attempted, the notification shall include a work plan and schedule for completion of the demonstration which shall be approved by the Chief of the Surface Water Quality Division. The effluent limits contained on page 4 of 23 take effect January 1, 1988, unless this permit is modified by the Water Resources Commission.

PART I, Section A

3. Special Condition - Long-Term Water Quality Based Effluent Limits

a. This special condition establishes the mechanism for proceeding toward achievement of water quality based effluent limits which are presently neither achievable nor detectable but are needed to protect the receiving water. These limits shall be defined as long-term water quality based effluent limits (LTWQBEL) and are as follows:

SUBSTANCES	DATES IN EFFECT	CONCENTRATION LIMIT (30 DAY AVERAGE)
PCB	All Year	1.2×10^{-5} ug/l

The permittee shall develop and submit to the Chief of the Surface Water Quality Division a long-term compliance plan on or before January 1, 1987. The plan shall include: (1) a program and schedule to make reasonable progress toward achieving the above limitations; (2) a proposal to use bio-monitoring or other techniques to determine progress toward compliance; (3) Any other information necessary to provide the demonstration required by Rule 323.1057(2)(f) for a scheduled abatement permit. After review of the long-term compliance plan, this permit may be modified by the Water Resources Commission in accordance with Part II, Section D-4 to incorporate requirements for proceeding toward achievement of the LTWQBEL.

b. This permit does not authorize the discharge of these substances at levels which are injurious to the designated uses of the waters of the state or which constitute a threat to the public health or welfare. In addition, the following requirements shall apply to outfall 001 :

SUBSTANCES	DATES IN EFFECT	ANALYTICAL METHOD	MONITORING FREQUENCY
PCB	All Year	EPA Method 608	2 X Monthly

Beginning on January 1, 1987, the discharge of these substances at detectable levels is a specific violation of this permit. The reported detection level for the method specified shall not exceed:

0.1 ug/l for PCB

unless a higher level is appropriate because of sample matrix interference.

M 3

EXCERPTS FROM
PERMIT NO. MI 0042994

PART I

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

6. Final Effluent Limitations (With addition of Thomas Solvent)

Beginning upon the ninth week following initiation of a discharge from the Thomas Solvent Company/Raymond Road Site and lasting until permit expiration, the permittee is authorized to discharge up to three million six hundred thousand gallons per day (3,600,000) of treated purged groundwater from outfall 001 to the Battle Creek River. Such discharge shall be limited and monitored by the permittee as specified below:

	Discharge Limitations				Monitoring Requirements	
	kg/day (lbs/day)		Other Limitations			
Effluent Characteristic	Monthly Average	Daily Maximum	Monthly Average	Daily Maximum	Measurement Frequency	Sample Type
Flow, M^3/Day (MGD)					Monthly	Report total daily flow
1,1 Dichloroethane*				2 ug/l	Monthly	Grab
1,2 Dichloroethane*				10 ug/l	Monthly	Grab
1,1,1-Trichloroethane*				14 ug/l	Monthly	Grab
Cis-1,2-Dichloroethylene*				10 ug/l	Monthly	Grab
1,1-Dichloroethylene*				1 ug/l	Monthly	Grab
Trichloroethylene*				5 ug/l	Monthly	Grab
Tetrachloroethylene*				3 ug/l	Monthly	Grab
Methylene Chloride*				10 ug/l	Monthly	Grab
Outfall Observation**					5x Weekly	Visual

*The permittee shall use analytical method 601 as listed in 40 CFR 136 ff. "Guidelines Establishing Test Procedures for the Analysis of Pollutants" proposed under authority of the Clean Water Act, 33 U.S.C. 1251 et seq.- Published in Federal Register 44 No. 233 pp. 69464f.

**Any unusual characteristics of the discharge which would not be expected from the above authorized discharge (i.e., turbidity, discoloration, oil film, suspended solids, etc.) shall be reported immediately to the District Office of the Surface Water Quality Division followed with a written report within 5 days detailing the findings of the investigation and the steps taken to correct the condition.

a. The pH shall not be less than 6.0 nor greater than 9.0. The pH shall be monitored as follows: Monthly; grab.

b. The discharge shall not cause excessive foam in the receiving waters. The discharge shall be essentially free of floating and settleable solids.

c. The discharge shall not contain oil or other substances in amounts sufficient to create a visible film or sheen on the receiving waters.

d. Samples, measurements, and observations taken in compliance with the monitoring requirements shall be taken after air stripper treatment system and prior to discharge to storm sewer or to the Battle Creek River.

7. Special Condition: Groundwater Analysis

The permittee shall sample the purge treatment system influent and effluent and analyze for the EPA priority pollutants twice a year (January and July) in accordance with the Part I, C-4 Schedule of Compliance.

The analysis shall be done in accordance with the following EPA 600 series methods or by methods approved by the Chief of the Surface Water Quality Division.

EPA Method 601 - For Purgeable Halocarbons
EPA Method 602 - For Purgeable Aromatic Hydrocarbons
EPA Method 625 - For Acid Compounds, Base/Neutral Compounds, and Pesticide/PCB Fractions

8. Special Condition

The discharger shall notify the Chief of the Surface Water Quality Division in writing, within 10 days of knowing, or having reason to believe, that any activity has occurred or will occur which would result in the discharge of:

1. Detectable levels** of chemicals on the current Michigan Critical Materials Register or priority pollutants or hazardous substances set forth in CFR 40, Vol. 45, No. 98, Part 122.53, Appendix D, pp. 33454-33455 which were not listed in the application*** or listed in the application at less than detectable levels.

2. Detectable levels** of any other chemical not listed in the application or listed at less than detection, for which the application specifically requested information.

3. Any chemical at levels greater than five times the average level reported in the application***.

Any other monitoring results obtained as a requirement of this permit shall be reported in accordance with the schedule of compliance.

**Detectable levels.

For Organic Chemicals:

The analytical level of detection (L.O.D.) shall be defined as three times the peak to peak noise measured on the baseline in an area close to the actual or suspected analyte peak as described in "Guidelines for Data Quality Evaluation in Environmental Chemistry", Analytical Chemistry, Vol. 52, No. 14, December, 1980.

The permittee may substitute the Method Detection Limit (M.D.L.) as described in "Trace Analyses for Wastewaters", Environmental Sciences and Technology, Vol. 15, No. 12, December, 1981, pp. 1426-1435, for the L.O.D.

For Inorganic Chemicals:

Detection levels are established in approved analytical procedures pursuant to Section 304(h) of the Clean Water Act, as amended.

***The application dated May 21, 1985

9. Special Condition

Beginning upon the ninth week following initiation of a discharge from the Thomas Solvent Company/Raymond Road Site and lasting until expiration of this permit, the permittee shall sample the purge treatment system effluent for the following parameters on a monthly basis in accordance with the EPA analytical methods specified below:

Chemical	EPA Analytical Method
Vinyl Chloride	601
Chloroform	601
1,2-trans-Dichloroethylene	601
Benzene	602
Xylene	602
Toluene	602
Ethyl Benzene	602
Acetone	656
Methyl Ethyl Ketone	8015
Methyl Isobutyl Ketone	8015
Carbon Tetrachloride	601
Naphthalene	610

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EXCERPTS FROM
PERMIT NO. MI 0000868

PART I

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

1. Final Effluent Limitations - Outfall 031

During the period beginning on the effective date of this permit and lasting until the expiration date of this permit, the permittee is authorized to discharge an average of twenty-six million five hundred thousand (26,500,000) gallons per day* and a maximum of forty-eight million three hundred thousand (48,300,000) gallons per day* of treated process wastewater, incinerator scrubber water, cooling tower blowdown, contact cooling water, noncontact cooling water, water softener backwash, landfill leachate, sanitary wastewaters and stormwater runoff from Outfall 031 to the Tittabawassee River. Such discharge shall be limited and monitored by the permittee as specified below:

a. Conventional Parameters

	Discharge Limitations				Monitoring Requirements	
Effluent Characteristic	Monthly Average kg/day	Daily Maximum (lbs/day)	Monthly Average	Daily Maximum	Measurement Frequency	Sample Type
Flow, M^3/Day (MGD)					Daily	
Total Suspended Solids (Net)	3000 (6630)	8202 (18127)	30 mg/l	45 mg/l	2 x Weekly	24 Hr. Comp.
BOD_5 (Net)					2 x Weekly	24 Hr. Comp.
Ammonia (as N) (Net)					2 x Weekly	24 Hr. Comp.
Fecal Coliform Bacteria May 1-October 31				400/100 ml	Weekly	Grab
Temperature (^{o}F)					Continuous	Reading Report Daily Avg. & Max.
pH			6.0 (min)	9.5	Continuous	Reading Report Daily Min. & Max.
Conductivity					Continuous	Reading Report Daily Avg. & Max.
Total Phosphorus (as P)					Monthly	Grab
Total Oxygen Demand					Daily	Grab
Outfall Observation**					Daily	Visual
Total Dissolved Solids*** (Net)		[3]	[2]	[1]	****	****

i. The term net shall be defined as the difference between the intake and discharge levels.

ii. The term continuous shall be defined as not less than 12 equally spaced readings taken within a 24 hour period. Report the appropriate daily minimum, average, and maximum.

*This flow is not to be considered an actual limitation.

**Any unusual characteristics of the discharge which would not be expected from treated process wastewater, incinerator scrubber water, cooling tower blowdown, contact cooling water, noncontact cooling water, water softener backwash, landfill leachate, sanitary wastewaters, and stormwater runoff (i.e., oil film, etc.) shall be reported immediately to the District Office of the Surface Water Quality Division, followed with a written report within 5 days detailing the findings of the investigation and the steps taken to correct the condition.

***[1]The TDS concentration which would result from the mixture of Dow's and the City of Midland's effluents with the background flow in the Tittabawassee River shall not exceed 750 mg/l as an instantaneous maximum. Compliance shall be determined using the following formula:

$$Qt\ (Ct-Cdi) \times 2.45 \leq (Qg + Qt - Qci)\ (750\ mg/l - Cdi) \times 2.45 + 3{,}000$$

Definition:

Qt = The flow from Dow Outfall 031, cfs

Ct = The TDS concentration in Dow Outfall 031, mg/l

Cdi = The TDS concentration in Dow's Tittabawassee River intake, mg/l

Qg = The flow at the Midland USGS gage, cfs

Qci = The flow in CPCO's Tittabawassee River intake, cfs.

Qt (Ct - Cdi) x 2.45 = Dow's net TDS load from Outfall 031, kg/day

Qg + Qt - Qci = The flow in the river available to assimilate Dow's TDS loading, cfs

750 mg/l - Cdi = The difference between the maximum allowable TDS concentration in the Tittabawassee River at Freeland Road and the background TDS concentration. This is the assimilative capacity for TDS per cfs of river flow.

3,000 Kg/day = The assimilative capacity utilized by all Dow outfalls other than 031 (-2,000 kg/day) plus the assimilative capacity added by the Midland WWTP (5,000 kg/day).

[2] The TDS concentration which would result from the mixture of Dow's and the City of Midland's effluents with the background flow in the Tittabawassee River shall not exceed 500 mg/l as a monthly average. Compliance shall be determined by calculating the TDS concentration of this mixture daily and then computing a monthly average. The following formulas are to be used:

$$\frac{\sum_{n=1}^{30} Cd(Dow)_n}{30} \leq 500 \text{ mg/l}$$

$$Cd\ (Dow) = (Qg\ Cdi + 8{,}000 - Qci\ Cdi + Qt\ Ct)/(Qg - Qci + Qt + 13)$$

Definitions:

Cd (Dow) = The TDS concentration which would result from the mixture of Dow's and the City of Midland's effluents with the background flow in the Tittabawassee River, mg/l.

Qg Cdi = The background TDS load.

8,000 = The TDS load from all Dow outfalls other than 031 [800 (mg/l)(cfs)] plus the TDS load discharged by the City of Midland [7,500 (mg/l)(cfs)].

Qci Cdi = The TDS load removed by Consumer Power Company's (CPCo's) intake.

Qt Ct = The TDS load from Dow Outfall 031.

Qg - Qci + Qt + 13 = The flow in the Tittabawassee River downstream of Lingle Drain, including 13 cfs from the Midland WWTP.

[3] To serve as an allocation of the assimilative capacity between Dow and CPCo, Dow's maximum TDS loading shall be limited as follows:

When the average daily flow at the Midland USGS gage is less than or equal to 1,400 cfs or Dow is discharging from Outfall 012:

$$(Qt\ Ct - 29\ Cdi) \times 2.45 + 2{,}000 \text{ kg/day} \leq 408{,}000 \text{ kg/day}$$

When the average daily flow at the Midland USGS gage is greater than 1,400 cfs and Dow is not discharging from Outfall 012:

$$Qt(Ct-Cdi) \times 2.45 \leq [(Qg + Qt - Qci)(500-Cdi)-Qbd(1100-500)] \times 2.45 - 5000$$

Definitions:

(Qt Ct - 29 Cdi) x 2.45 = Dow's net TDS load from Outfall 031, kg/d.

2,000 kg/day = Dow's net TDS load from all Dow outfalls other than 031.

Qbd - The flow (blowdown) from Consumers Power Company's cooling pond, cfs.

1100 - The maximum TDS concentration ever expected in CPCo's cooling pond blowdown, mg/l.

(Qg + Qt-Qci)(500-Cdi) - The assimilative capacity for TDS.

Qbd(1100-500) - The assimilative capacity for TDS utilized by Consumers Power Company.

5000 - The assimilative capacity for TDS utilized by the City of Midland and Dow outfalls other than 031.

****Monitoring requirements for determination of compliance for the TDS limitations are as follows:

TDS concentration at Freeland Road (Cd) - monitor conductivity continuously. Measure conductivity and TDS concentrations on the same grab sample weekly. Use the most recently measured TDS/conductivity ratio and continuous conductivity measurements to compute TDS concentration at Freeland Road. Report the daily average and daily maximum TDS concentrations. Report the beginning and ending times during which the calculated TDS concentration is above 750 mg/l. Also, report the weekly TDS measurement and corresponding conductivity measurement.

TDS concentration in Dow's Tittabawassee River water intake (Cdi) - monitor conductivity continuously. Measure conductivity and TDS on the same grab sample weekly. Use the most recently measured TDS/conductivity ratio and the continuous conductivity measurements to compute TDS concentrations. Report the daily average TDS concentration.

Flow from Dow Outfall 031 (Qt) - monitor continuously and report the daily average.

TDS concentration in Dow Outfall 031 (Ct) - monitor conductivity continuously. Analyze a 24 hour composite sample for TDS and conductivity twice weekly and report the results.

Midland USGS gage flow (Qg) - monitor continuously and report the daily average flow based on the average gage height, the USGS rating table effective at the time of the measurement and the correction factor from the most recent gage calibration by USGS.

Consumers Power cooling pond discharge flow (Qbd) - monitor continuously and report the daily average.

Consumers Power intake flow (Qci) - monitor continuously and report the daily average.

$$\text{Cd (Dow)} = \frac{\text{Qg Cdi} + 8{,}000 - \text{Qci Cdi} + \text{Qt Ct}}{\text{Qg} - \text{Qci} + \text{Qt} + 13}$$ - calculate and report the daily average

$$\text{Qt (Ct-Cdi)} \times 2.45 \frac{\text{kg/d}}{(\text{mg/l})(\text{cfs})}$$ - monitor continuously and report the daily average

$$(\text{Qt Ct} - 29\ \text{Cdi}) \times 2.45 \frac{\text{kg/d}}{(\text{mg/l})(\text{cfs})} + 2{,}000\ \text{kg/d}$$ - calculate and report the daily average.

$$\text{Qt(Ct-Cdi)} \times 2.45,\ [(\text{Qg} + \text{Qt} - \text{Qci})(500-\text{Cdi})-\text{Qbd}(1100-500)] \times 2.45 - 500$$

Calculate and report the daily average when the average daily flow at the Midland USGS gage $>$ 1400 cfs.

Beginning 24 hours prior to the time when the TDS concentration at Freeland Road is above 750 mg/l and ending when the TDS concentration at Freeland Road is less than 750 mg/l, report the following parameters at hourly intervals: the TDS concentration in the Tittabawassee River at Freeland Road, Ct, Qt, Cdi, Qg, Qci, Qt (Ct - Cdi) x 2.45 and

$$(\text{Qg} + \text{Qt} - \text{Qci})\ (750\ \text{mg/l} - \text{Cdi}) \times 2.45 \frac{\text{kg/d}}{(\text{mg/l})(\text{cfs})} + 3{,}000\ \text{kg/d}^{*}$$

TDS concentrations from Dow Outfalls 005 and 012, are to be measured and reported twice weekly when discharging. TDS concentrations from Dow Outfalls 014 and 015 are to be measured and reported twice monthly when discharging.

Average flows from Dow Outfalls 005, 012, 014, and 015 are to be measured and reported daily.

*When the computer controlling Dow's discharge from Outfall 031 is down, the following parameters may be measured and reported once very eight hours, rather than hourly: The TDS concentration in the Tittabawassee River at Freeland Road, Ct, Cdi, Qt (Ct-Cdi) x 2.45 and (Qg + Qt - Qci) (750 mg/l - Cdi) x 2.45 kg/d/(mg/l cfs) + 3,000 kg/d.

b. Nonconventional/Toxic Pollutants

Effluent Characteristic	Discharge Limitations				Monitoring Requirements	
	Monthly Average kg/day	Daily Maximum (lbs/day)	Monthly Average	Daily Maximum	Measurement Frequency	Sample Type
Phenol	7.5 (16.6)	18.2 (40.3)	75 ug/l	100 ug/l	2 x Monthly	Grab
2,4-Dichlorophenoxyacetic acid	0.1** (0.2)	0.5** (1.1)	100 ug/l		2 x Monthly	Grab
Bis(2-chloroethyl)ether	1.0 (2.2)		10 ug/l		2 x Monthly	Grab
Chloroform	9.1 (19.9)		90 ug/l		2 x Monthly	Grab
2,3,7,8-Tetrachlorodibenzo-p-dioxin				(*)	2 x Monthly	Grab
1,1,2,2-Tetrachloroethane	5.1 (11.1)		50 ug/l		2 x Monthly	Grab
Tetrachloroethylene	4.5 (9.9)		45 ug/l		2 x Monthly	Grab
1,1,2-Trichloroethane	7.1 (15.5)		70 ug/l		2 x Monthly	Grab
Pentachlorophenol	5.1 (11.1)	10.1 (22.2)	50 ug/l	55 ug/l	2 x Monthly	Grab
From Effective Date of Permit to 9/30/85						
1,3-Dichlorobenzene					2 x Monthly	Grab
1,4-Dichlorobenzene					2 x Monthly	Grab
1,2,4-Trichlorobenzene					2 x Monthly	Grab
Methylene Chloride					2 x Monthly	Grab
2-Chlorophenol					2 x Monthly	Grab
2,4-Dichlorophenol					2 x Monthly	Grab
Napthalene					2 x Monthly	Grab
1,1,1-Trichloroethane					2 x Monthly	Grab
Bromoform					2 x Monthly	Grab
Chlorobenzene					2 x Monthly	Grab
From 10/1/85 to Permit Expiration						
1,3-Dichlorobenzene					2 x Monthly	Grab
1,4-Dichlorobenzene	7.5 (16.6)		75 ug/l		2 x Monthly	Grab

Effluent Characteristic	Discharge Limitations Monthly Average kg/day	 Daily Maximum (lbs/day)	 Monthly Average	 Daily Maximum	Monitoring Requirements Measurement Frequency	 Sample Type
1,2,4-Trichlorobenzene					2 x Monthly	Grab
Methylene Chloride					2 x Monthly	Grab
2-Chlorophenol					2 x Monthly	Grab
2,4-Dichlorophenol	6.0 (13.3)		60 ug/1		2 x Monthly	Grab
Napthalene					2 x Monthly	Grab
1,1,1-Trichloroethane					2 x Monthly	Grab
Bromoform	23.0 (50.8)		230 ug/1		2 x Monthly	Grab
Chlorobenzene					2 x Monthly	Grab

(*)State-of-the-art analytical techniques are not sufficiently sensitive to detect this bioaccumulative and toxic chemical at a level in the effluent which is or may become injurious to the uses of the waters of the State or constitutes a threat to the public health or welfare. The discharge of this chemical at a level which is or may become injurious is prohibited. In addition to this prohibition, the discharge of this chemical at a level greater than or equal to the Method Detection Limit (M.D.L.) is a specific violation of this permit.

The Method Detection Limit (M.D.L.) is defined in "Trace Analyses for Wastewaters", Environmental Science & Technology, Vol. 15, No. 12, December 1981, pp. 1426-1435.

The permittee may substitute the level of detection (L.O.D.) as defined on page 26, for the Method Detection Limit (M.D.L.).

Monitoring for 2,3,7,8-TCDD shall be by the large volume sampling and HRGC-HRMS analysis techniques cited in Appendix C of the EPA report entitled "Dow Chemical Company - Midland Plant - Wastewater Characterization Study", March 28, 1983, or an alternate method approved by the Chief of the Surface Water Quality Division.

**Compliance monitoring for the EPA categorical standards for 2,4-Dichlorophenoxyacetic acid mass limitations shall be performed at the production facility. Samples shall be taken from the production facility wastewater stream prior to discharge to the sewer system, hereby designated as sampling location 031a. To assure protection of production information, samples taken at this location shall be analyzed for 2,4-Dichlorophenoxyacetic acid only.

Pursuant to notification dated December 19, 1983, Dow no longer manufactures chlorobenzene. Prior to placing the chlorobenzene process back in production, if ever, Dow shall apply for and receive permit modifications establishing effluent limitations for hexachlorobenzene and PCBs.

2. Interim Effluent Limitations - Outfall 031

Nonconventional/Toxic Pollutants

During the period beginning on the effective date of this permit and lasting until September 30, 1985, the permittee is authorized to discharge an average of twenty-six million five hundred thousand (26,500,000) gallons per day* and a maximum of forty-eight million three hundred thousand (48,300,000) gallons per day* of treated process wastewater, incinerator scrubber water, cooling tower blowdown, contact cooling water, noncontact cooling water, water softener backwash, landfill leachate, sanitary wastewaters and stormwater runoff from Outfall 031 to the Tittabawassee River. Such discharge shall be limited and monitored by the permittee as specified below:

	Discharge Limitations				Monitoring Requirements	
Effluent Characteristic	Monthly Average kg/day	Daily Maximum (lbs/day)	Monthly Average	Daily Maximum	Measurement Frequency	Sample Type
Carbon Tetrachloride					2 x Monthly	Grab
2,4,6-Trichlorophenol					2 x Monthly	Grab
1,2-Dichlorobenzene					2 x Monthly	Grab
Acrylonitrile					2 x Monthly	Grab

*This flow is not to be considered an actual limitation.

3. Final Effluent Limitations - Outfall 031

Nonconventional/Toxic Pollutants

During the period beginning October 1, 1985, and lasting until the expiration date of this permit, the permittee is authorized to discharge an average of twenty-six million five hundred thousand (26,500,000) gallons per day* and a maximum of forty-eight million three hundred thousand (48,300,000) gallons per day* of treated process wastewater, incinerator scrubber water, cooling tower blowdown, contact cooling water, noncontact cooling water, water softener backwash, landfill leachate, sanitary wastewaters and stormwater runoff from Outfall 031 to the Tittabawassee River. Such discharge shall be limited and monitored by the permitee as specified below:

	Discharge Limitations				Monitoring Requirements	
Effluent Characteristics	Monthly Average kg/day	Daily Maximum (lbs/day)	Monthly Average	Daily Maximum	Measurement Frequency	Sample Type
Carbon Tetrachloride	5.9 (13.0)		59 ug/l**		2 x Monthly	Grab
2,4,6-Trichlorophenol	0.8 (1.8)	9.7 (21.3)	8 ug/l**	53 ug/l	2 x Monthly	Grab
1,2-Dichlorobenzene	1.7 (3.8)		17 ug/l**		2 x Monthly	Grab
Acrylonitrile	0.6 (1.3)		6 ug/l**		2 x Monthly	Grab

NOTE: Prior to the issuance of this permit, the permittee submitted a proposal to develop a diffuser system for rapid mix of the Outfall 031 discharge with the Tittabawassee River. The diffuser proposal is to construct a diffuser in accordance with plans and specifications approved by the Chief of the Surface Water Quality Division which will accomplish the following minimum criteria:

a. Provide for rapid mix of 26.5 MGD of effluent with 225 cfs of the Tittabawassee River flow such that complete mix will occur within 200 feet downstream of the diffuser.

b. Allow the passage of fish and fish food organisms so that effects on their immediate and future populations are negligible or not measurable. This will be determined by a fish avoidance study conducted by the permittee and approved by the Chief of the Surface Water Quality Division.

The Commission has reviewed this proposal and has determined that upon determination by the Chief of the Surface Water Quality Division that the above criteria will be met; and upon construction and placement into operation, and verification by the Chief of the Surface Water Quality Division that the above criteria are met and will be met on a continuing basis, the effluent limitations set forth in Part I.A.4 shall supersede those set forth in Part I.A.3, and shall be in full force and effect. This does not obviate the necessity of obtaining all other permits and approvals necessary for the construction of this equipment.

*This flow is not to be considered an actual limitation.

**If necessary to assure compliance with the state's water quality standards in the receiving stream Dow may elect to discharge treated wastewater from Outfall 031 at a discharge rate of less than twenty-six million five hundred thousand (26,500,000) gallons per day on a thirty day average, in which case the monthly average concentration limitation shall be determined as stated below:

	30-Day Average Concentration
Carbon Tetrachloride	$\left(21 + \frac{1017}{Q_E}\right)$, ug/l
2,4,6-Trichlorophenol	$\left(3 + \frac{145}{Q_E}\right)$, ug/l
1,2-Dichlorobenzene	$\left(6 + \frac{291}{Q_E}\right)$, ug/l
Acrylonitrile	$\left(2 + \frac{97}{Q_E}\right)$, ug/l

Where Q_E = the 30-day ave. flow from 031 in MGD.

4. Final Effluent Limitations - Outfall 031 with Diffuser

Nonconventional/Toxic Pollutants

During the period beginning October 1, 1985, and lasting until the expiration date of this permit, the permittee is authorized to discharge an average of twenty-six million five hundred thousand (26,500,000) gallons per day* and a maximum of forty-eight million three hundred thousand (48,300,000) gallons per day* of treated process wastewater, incinerator scrubber water, cooling tower blowdown, contact cooling water, noncontact cooling water, water softener backwash, landfill leachate, sanitary wastewaters and stormwater runoff from Outfall 031 to the Tittabawassee River. Such discharge shall be limited and monitored by the permittee as specified below:

	Discharge Limitations				Monitoring Requirements	
Effluent Characteristic	Monthly Average kg/day	Daily Maximum (lbs/day)	Monthly Average	Daily Maximum	Measurement Frequency	Sample Type
Carbon Tetrachloride	13.6 (29.8)		135 ug/l		2 x Monthly	Grab
2,4,6-Trichlorophenol	1.9 (4.2)	9.7 (21.3)	19 ug/l**	53 ug/l	2 x Monthly	Grab
1,2-Dichlorobenzene	3.9 (8.6)		39 ug/l**		2 x Monthly	Grab
Acrylonitrile	1.3 (2.9)		13 ug/l**		2 x Monthly	Grab

*This flow is not to be considered an actual limitation.

**If necessary to assure compliance with the state's water quality standards in the receiving stream Dow may elect to discharge treated wastewater from Outfall 031 at a discharge rate of less than twenty-six million five hundred thousand (26,500,000) gallons per day on a thirty day average, in which case the monthly average concentration limitation shall be determined as stated below:

	30-day Average Concentration
2,4,6-Trichlorophenol	$\left(3 + \frac{436}{Q_E}\right)$, ug/l
1,2-Dichlorobenzene	$\left(6 + \frac{872}{Q_E}\right)$, ug/l
Acrylonitrile	$\left(2 + \frac{291}{Q_E}\right)$, ug/l

Where Q_E = the 30-day ave. flow from 031 in MGD.

9. Special Condition - Fish Biouptake Study

The permittee shall conduct two fish biouptake studies during the life of the permit on the effect of Outfall 031 effluent in accordance with the schedule specified in Part I, C-1. The chemicals to be monitored in fish include:

Acrylonitrile
Aldrin
Alpha BHC
Aniline
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
2,4-Dichlorophenol
Heptachlor epoxide
Hexachlorobenzene
1242 PCB
1254 PCB
1260 PCB
Pentachlorobenzene
Pentachlorophenol
1,2,3,4-Tetrachlorobenzene
1,2,4,5-Tetrachlorobenzene
2,3,7,8-Tetrachlorodibenzo furan
2,3,7,8-Tetrachlorodibenzo-p-dioxin
1,2,3-Trichlorobenzene
1,2,4-Trichlorobenzene
2,4,5-Trichlorophenol
2,4,6-Trichlorophenol

A study plan should be submitted to the Chief of the Surface Water Quality Division for approval prior to implementation of the above study. The plan shall include a description of the location of sampling or exposure, sampling or exposure apparatus, sample handling and processing, analytical methods, and other procedures pertinent to the successful completion of the study. Staff of the MDNR will be provided the opportunity to split samples upon request and to modify the above parameter list following review of the first study.

10. Special Condition - Chronic Aquatic Bioassay

The permittee shall conduct a chronic aquatic bioassay on the effluent from Outfall 031 under normal operating conditions in accordance with Part I, C-2. The test species shall include a Daphnia sp. and a rainbow trout or fathead minnow. Test procedures shall be submitted to the Chief of the Surface Water Quality Division for approval prior to implementation.

11. Special Condition - Acute Toxicity Data

The permittee shall supply acute toxicity data for the following chemicals in accordance with Part I, C-3.

Aniline
Bis(2-chloroethoxy)methane
Dinoseb
P-chloro-m-cresol
Silvex

The minimal characterization of aquatic toxicity for Bis(2-chloroethoxy)methane and Dinoseb includes: 1) a 96 hour LC50 for rainbow trout or fathead minnow and 2) a 48 hour EC50 for a Daphnia sp.

The minimal characterization of aquatic toxicity for P-chloro-m-cresol, Aniline and Silvex include: 1) a 48 hour EC50 for a Daphnia sp.

Testing procedures shall follow ASTM standard E729-80. Prior to conducting the testing, a plan shall be submitted to the Chief of the Surface Water Quality Division for approval.

Staff will review the acute toxicity data generated and where appropriate recommend water quality-based effluent limitations.

12. Special Condition - Wastewater Characterization

The permittee shall monitor the Outfall 031 effluent in accordance with Part I, C-4, and the following:

A. Monitor Table I parameters 3 times during the first year of the permit. For those chemicals detected, monitor on an annual basis thereafter.

B. Conduct an annual GC/MS scan for EPA priority pollutants and all other nitrogen, phosphorus or halogen containing chemicals which:

   1) Produce a peak response signal to background noise ratio of 50 to 1 or greater, and

*For these chemicals, the study plan shall include analytical methods to enhance sensitivity beyond that given in the application dated December 28, 1982, as amended to date. Upon verification by the Chief of the Surface Water Quality Division that such enhanced sensitivity is above the level of concern for any specific chemical, then the most sensitive reliable method that produces specificity will be used.

13. Special Condition - Inorganic Substance Study

The permittee shall submit to the Chief of the Surface Water Quality Division a plan for the quantification of the following chemicals in the specified outfall in accordance with Part I.C.5. The study shall be conducted for a six month period.

	Detection Sensitivity	Outfall
Cadmium	0.2 ug/l	031

The study plan shall include: a description of sampling locations, sample type, frequency and duration of sampling, sample handling and storage techniques, sample processing, analytical methods to be employed, and quality control and quality assurance procedures to be employed.

Staff will review the results, and where appropriate recommend water quality-based effluent limitations.

14. Special Condition

The seven day once in ten year drought flow in the Tittabawassee River downstream of the confluence of the Chippewa River is 136 cfs if no water is released from the Sanford Dam. Dow Chemical Company has contracted with Wolverine Power Company to provide 300 cfs as a minimum daily average flow at the Midland USGS gage, and has requested that this flow be used in determining water quality-based effluent limit recommendations. The permit conditions specified in Part I are based on the maintenance of a minimum flow of 300 cfs in the Tittabawassee River at the Midland USGS gage. Discharges pursuant to conditions specified in Part I of this permit may adversely impact on the water quality of the Tittabawassee when the river flow is less than 300 cfs as a daily average at the Midland USGS gage. Therefore, whenever the daily average flow as determined at the Midland USGS gage is less than 300 cfs, Dow Chemical Company shall cease all discharges from outfall 031 as quickly as practicable, but as a maximum within 24 hours. Any subsequent discharges from Outfall 031 are expressly prohibited and a violation of this permit. Discharges may thereafter recommence after a 24-hour average flow at or above 300 cfs is available.

C. SCHEDULE OF COMPLIANCE

1. The permittee shall conduct two fish biouptake studies during the life of the permit on the effects of Outfall 031 effluent and appropriate controls as specified in Part I.A. 9 in accordance with the following schedule. All submittals shall be to the Chief of the Surface Water Quality Division.

   a. On or before January 1, 1985, the permittee shall submit and obtain approval of a plan for conducting two fish biouptake studies on the effects of Outfall 031 effluent and appropriate controls.

   b. On or before July 1, 1985, the permittee shall implement the approved plan for conducting two fish biouptake studies on the effects of Outfall 031 effluent and appropriate controls.

   c. On or before January 1, 1986, the permittee shall submit the results of the first fish biouptake study conducted on the effects of Outfall 031 effluent and appropriate controls.

   d. On or before January 1, 1988, the permittee shall submit the results of the second fish biouptake study conducted on the effects of Outfall 031 effluent and appropriate controls.

2. The permittee shall conduct a chronic aquatic bioassay on the effluent from Outfall 031 as specified in Part I.A. 10 in accordance with the following schedule. All submittals shall be to the Chief of the Surface Water Quality Division.

   a. On or before January 1, 1985, the permittee shall submit a plan for conducting a chronic aquatic bioassay on the effluent from Outfall 031.

   b. Within one year following approval of the chronic aquatic bioassay study plan the permittee shall submit the results of the study.

3. The permittee shall supply acute toxicity data on the chemicals specified in Part I.A.11 in accordance with the following schedule. All submittals shall be to the Chief of the Surface Water Quality Division.

   a. On or before June 1, 1984, the permittee shall submit and obtain approval of a plan for supplying acute toxicity data on the chemicals specified.

b. On or before July 1, 1984, the permittee shall implement the approved plan for supplying acute toxicity data on the chemicals specified.

c. On or before January 1, 1985, the permittee shall submit the results of the acute toxicity data on the chemicals specified.

4. The permittee shall conduct a wastewater characterization as specified in Part I.A.12 in accordance with the following schedule. All submittals shall be to the Chief of the Surface Water Quality Division.

   a. On or before June 1, 1984, the permittee shall submit and obtain approval of a plan for analyzing those chemicals listed in Table I and for conducting a GC/MS scan on Outfall 031.

   b. On or before July 1, 1984, the permittee shall implement the approved plan for analyzing chemicals on Table I and for conducting a GC/MS scan on Outfall 031.

   c. On or before July 1, 1985, the permittee shall submit the results of the 3 analyses of chemicals on Table I.

   d. On or before January 1 of each year, the permittee shall submit the results of the GC/MS scan on Outfall 031 and the results for those chemicals required to be analyzed from Table I.

5. The permittee shall achieve compliance with the "Inorganic Substance Study" special condition of Part I.A. 13 in accordance with the following schedule. All submittals shall be to the Chief of the Surface Water Quality Division.

   a. On or before June 1, 1984, the permittee shall submit and obtain approval of a plan for quantification of cadmium.

   b. On or before July 1, 1984, the permittee shall implement the approved study plan.

   c. On or before March 1, 1985, the permittee shall submit the results of the quantification study.

6. The permittee shall achieve compliance with the ammonia effluent limitations specified for all outfalls in Part I.A.7 in accordance with the following schedule:

   a. On or before January 1, 1985, the permittee shall submit a progress report to the Chief of the Surface Water Quality Division.

FL-1

EXCERPTS FROM
PERMIT NO. FL 0037966

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET
ATLANTA GEORGIA 30365

PERMIT NO. FL0037966

AUTHORIZATION TO DISCHARGE UNDER THE
NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Clean Water Act, as amended, (33 U.S.C. 1251 et seq.; the "Act"),

City of Orlando
Public Works Division
400 South Orange Avenue
Orlando, Florida 32801

is authorized to discharge from a facility located at

Iron Bridge Road Water Pollution Control Facility
P.O. Box [illegible]
Oviedo, Florida 32765

to receiving waters named

Outfall 001 - Little Econlockhatchee River

Outfall 002 - Discharge from artificial wetlands to unnamed ditch thence to natural wetlands to the St. Johns River

in accordance with effluent limitations, monitoring requirements and other conditions set forth herein. The permit consists of this cover sheet, Part I _7_ page(s). Part II _15_ page(s), Part III _1_ page(s), and Part IV _2_ page(s).

This permit shall become effective on

This permit and the authorization to discharge shall expire at midnight,

Date Signed

Bruce R. Barrett, Director
Water Management Division

PART I (CONTINUATION)
EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

2. In addition to the specified limits, the monthly average effluent BOD_5 and suspended solids concentrations shall not exceed 15% of the respective influent values (85% Removal).

3. The arithmetic mean of the monthly fecal coliform values, collected during an annual period, shall not exceed 200 colonies per 100 ml of effluent sample. No more than ten percent of the fecal coliform samples collected during a period of 30 consecutive days shall exceed 400 fecal coliform colonies per 100 ml of effluent sample. Any one sample shall not exceed 800 fecal coliform colonies per 100 ml of effluent sample.

4. The pH of the effluent shall not be less than 6.0 standard units nor greater than 8.5 standard units. If hourly grab samples are collected, such samples will be collected during the period for required operator attendance.

5. There shall be no discharge of floating solids or visible foam in other than trace amounts.

6. The effluent shall not cause a visible sheen on the receiving water.

7. Any bypass of the treatment facility which is not included in the effluent monitored above, is to be monitored for flow and reported on a Discharge Monitoring Report (DMR) Form (3320-1).

8. The mass limitations specified are based on a design flow of 24.0 MGD.

9. The effluent dissolved oxygen concentration shall be a minimum of 7.0 mg/l.

10. The total residual chlorine daily maximum effluent concentration in the final effluent shall not exceed 0.021 mg/l. Testing for this parameter shall be conducted according to either the amperometric titration method or the DPD ferrous colorimetric method as specified in Sections 408(C) or (E), Standard Methods for the Examination of Water and Wastewater, 16th edition. Compliance with this requirement shall be achieved by January 1, 1985. Quarterly reports of progress beginning from the effective date of this permit shall be submitted to the Permit Issuing Authority.

11. a. The effluent (100%) shall not be lethal to more than 50% of appropriate test organisms. The testing for this requirement must conform with Part IV of this permit. Lethality to more than 50% of the test organisms in a test of 96 hours duration will constitute a violation of Florida Administrative Code Section 17-4.244(4) and the terms of this permit.

b. The effluent shall not be chronically toxic to, or produce adverse physiological or behavioral responses in aquatic animals. An effluent no observable effect level (NOEL) of less than 46% will constitute a violation of Florida Administrative Code 17-3.061(2)(p) and the terms of this permit.

Part IV
Biomonitoring Program

In accordance with Part I of this permit, the permittee shall initiate the series of tests described below within 90 days of the effective date of this Part to evaluate wastewater toxicity of the discharge from outfall(s) 001.

1. The permittee shall conduct a 7-Day Ceriodaphnia Survival and Reproduction Test and a 7-Day Fathead Minnow (Pimephales promelas) Larval Survival and Growth Test on samples of final effluent. Toxicity will be demonstrated if more than 50% lethality of the test organisms occurs in 96 hours in 100% effluent or the no observable effect level (NOEL) is less than 46 %. All tests will be conducted on 24-hour composite samples of final effluent. All test solutions shall be renewed daily. If, in any control, more than 10% of the test organisms die in 96 hours or more than 20% of the test organisms die in 7 days, that test (control and effluent) shall be repeated. Such testing will determine whether the effluent affects the survival, reproduction, and/or growth of the test organisms.

2. The toxicity tests specified above shall be conducted once every two months for a period of one year following initiation of the tests and once every 6 months thereafter for the duration of the permit. Results shall be reported according to EPA/600/4-85/014, Section 10, Report Preparation, and shall be submitted to EPA with the monthly discharge monitoring report. If any one test shows lethality to more than 50% of the test organisms in 100% effluent in 96 hours, then the provisions of Section 3 apply. If any one test indicates that the NOEL is less than 46%, another confirmatory toxicity test using the specified methodology and the same test species shall be conducted within 2 weeks. If this confirmatory test indicates that the NOEL is less than 46 %, then the provisions of Section 3 shall apply. If the NOEL is not less than 46 % in this confirmatory test, then the provisions of Section 3 will not apply.

3. If toxicity (greater than 50% lethality of test organisms in 100% effluent in 96 hours or a NOEL of less than 46 % in a confirmatory test) is found in any of the tests specified above, this will constitute a violation of this permit. The permittee will then be subject to the enforcement provisions of the Clean Water Act. In the event a violation of toxicity limits results in an enforcement action, any different or more stringent monitoring requirements imposed in that enforcement action shall apply in lieu of the requirements of this permit condition for whatever period of time is specified by EPA in the enforcement action.

4. All test organisms, procedures and quality assurance criteria used shall be in accordance with *Short-term Methods For Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, Section 13: Ceriodaphnia Survival and Reproduction Test Method 1002.0 and Section 11: Fathead Minnow (Pimephales promelas) Larval Survival Growth Test Method 1000.0*, EPA-600/4-85-014. The permittee's selection of an appropriate control water for the toxicity tests shall be submitted to EPA for review and approval prior to use.

f. Description of Discharges (as reported by applicant)

Outfall Serial No. - 001

Effluent Characteristic	Reported Value
Flow (Annual Average)	24 MGD
BOD_5	5 mg/l
TSS	5 mg/l

Outfall Serial No. - 002

Effluent Characteristic	Reported Value
Flow (Annual Average)	20 MGD
BOD_5	5 mg/l
TSS	5 mg/l

4. PROPOSED EFFLUENT LIMITATIONS

See the attached draft permit. These proposed limitations are based on revoking and reissuing the current NPDES permit. Such a reissued permit would have a five year term.

5. BASIS FOR EFFLUENT LIMITS AND PERMIT CONDITIONS

Outfall 001 - The minimum and monthly average limits for BOD_5 and TSS are based on the existing permit. Weekly average limits for BOD_5 and TSS have been changed to conform to Florida Administrative Code (FAC) Section 17-6.110. The permit contains effluent limits for fecal coliforms, to conform with FAC Section 17-3.121(5). Mass limits for total nitrogen and total phosphorus in the permit conform with total nutrient loading requirements to Lake Harney, as required in the State construction permit. The resulting concentration limits for TN and TP are consistent with the provisions of the January 15, 1979 EPA Advanced Treatment review. A dissolved oxygen requirement is established in the permit to conform with FAC Section 17-3.121(15). Monitoring frequencies and types for all of the above parameters conform with FAC Section 17-19.05.

Toxicity tests conducted by FDER on post- and de-chlorinated effluent in April, 1984 and February, 1985 indicated that the effluent was toxic to *Daphnia pulex* and *Heterandrea formosa*. Based on these indications that the effluent from outfall 001 may be toxic, toxicity testing requirements as contained in Item 11 on Page I-3 and in Part IV have been included in the permit to insure that the wastewater effluent from outfall 001 conforms with FAC Sections 17-4.244(4), 17-3.061(2)(p), and Regional policy as contained in the document, "Whole Effluent Toxicity Testing Policy for Florida", dated May 5, 1986. Based on a 7Q10 flow of 42 cfs for the Little Econlockhatchee River from FDER wasteload allocation documentation, an instream waste concentration (IWC) of 46% will exist at a discharge flow of 24 MGD after complete mixing at low flow conditions.

Total residual chlorine (TRC) limitations for outfall 001 have been established in accordance with FAC 17-3.121(10) and the document "Region IV NPDES Permits Chlorine Strategy", dated April 11, 1986. Based on a 7Q10 flow of 42 cfs, a 0.011 mg/l daily maximum TRC limit has been included in the draft permit. The monitoring frequency and compliance schedule for TRC are based on the April 11, 1986 document cited above.

FL-2

EXCERPTS FROM
PERMIT NO. FL 0000892

Example of Permit
With Acute Limit

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION IV

345 COURTLAND STREET
ATLANTA, GEORGIA 30365

AUTHORIZATION TO DISCHARGE UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Clean Water Act, as amended (33 U.S.C. 1251 et. seq; the "Act"),

Alton Packaging Corporation
P.O. Box 150
Jacksonville, FL 32201

is authorized to discharge from a facility located at

Jacksonville Containerboard Mill
1915 Wigmore Street
Jacksonville, FL 32201

to receiving waters named

The St. John's River
(Outfalls 001 and 002)

in accordance with effluent limitations, monitoring requirements and other conditions set forth herein. The permit consists of this cover sheet, Part I 8 page(s), Part II 15 page(s), Part III 2 page(s), and Part IV 2 page(s).

This permit was originally issued on September 27, 1984, and became effective on November 1, 1984. Portions of the permit are hereby are modified by this permit action and shall become effective January 1, 1986. (The full permit is being reprinted for clarity.)

This permit and the authorization to discharge shall expire at midnight, October 31, 1989.

December 20, 1985
Date Signed

John T. Marlar for
Bruce R. Barrett, Director
Water Management Division

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

1. Outfall 001 continued.

a. Effluent Limit:

The effluent (100%) shall not be lethal to more than 50% of an appropriate fish and invertebrate test organism in a 96 hour test (96 hour LC_{50}). Failure to demonstrate compliance with the acute toxicity requirement will constitute a violation of the terms of this permit.

b. In order to comply with the above limit the following actions are required:

1. The permittee shall initiate the series of tests described below within 90 days of the effective date of this Part to evaluate wastewater toxicity. The permittee shall conduct a 48-hour static screening toxicity test on an appropriate fish and an invertebrate test species once every three months for a period of one year following the effective date of this Part and once every six months thereafter for the duration of the permit using samples of 100% whole effluent. Such static screening tests will be conducted on each of four grab samples of 100% effluent collected over a 24 hr. period in order to catch any peaks of toxicity and to account for diurnal variations in effluent quality. Results on 100% effluent for each grab sample shall be reported. The results of each toxicity test shall be submitted to EPA concurrent with monthly discharge monitoring reports.

   Once the permittee has demonstrated to the satisfaction of EPA that there are no effluent toxicity peaks and no diurnal toxicity variance, the above requirement for four (4) grab samples in a 24-hour period may be changed to one grab sample in a 24-hour period.

2. a. If any such screening test indicates that toxicity (less than 50% survival of test organisms in 100% effluent) is found in any sample of effluent, further confirmatory acute toxicity testing involving the determination of 96 hour LC_{50} values with 95 per cent confidence limits is required. A minimum of two (2) such 96-hour confirmatory tests are required to be conducted within 30 days from the date that any screening test indicates the presence of toxicity. Such tests shall be conducted using that test species which exhibited the most toxicity in the screening tests above. The results of each toxicity test shall be submitted to EPA concurrent with monthly discharge monitoring reports.

   b. If the presence of toxicity is confirmed in any 96 hr. test, this will constitute a violation of this permit. The permittee will then be subject to the enforcement provisions of the Clean Water Act.

3. All test organisms, procedures, and quality assurance criteria used shall be in accordance with Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms, EPA-600/4-85-013 and/or [illegible] Manual for Performing Acute Toxicity Tests, [illegible] of an appropriate control water for the [illegible] shall be submitted to EPA for review and approval prior to use.

The Phase 1 production basis was the actual 12 month average production for the period March 1984 through February 1985. The Phases 2,3, and 4 production bases represent incremental levels of production to be achieved after completion of specific items in the mill construction schedule.

Phase 1 through 4 limits are based on the above production figures and the BPT effluent guidelines (lb. of pollutant allowed per 1000 lb. of production) contained in 40 CFR Part 430 for the Unbleached Kraft Category (A) of the pulp and paper industry.

BCT effluent guidelines for the pulp and paper industry have not been promulgated.

The Clean Water Act requires compliance with BPT on or before 7-1-77, and BCT on or before 7-1-84. For the purpose of this permit is the judgement of EPA that BCT = BPT plus Best Management Practices plus a BCT reopener clause. Best management Practices requirements are included in the issued permit. A reopener clause is also included in the issued permit stating that the permit shall be modified, or revoked and reissued, to incorporate any more stringent BCT effluent limitations.

These revised permit limits are proposed to be incorporated into this permit in accordance with 40 CFR part 122.62(a) (1) Alterations and (2) Information.

Primarily because of available dilution in the St. Johns River, water quality based effluent limitations for BOD_5 are not required.

The permittee had also requested an increase in BOD_5 and TSS limitations based on log washing operations at the mill. Log washing operations do not receive an additional BOD_5 and TSS (BPT) allowance under Category A of the Pulp and Paper Effluent Guidelines, though they do under other categories.

Toxicity Testing:

In the 9/27/84 issuance under whole waste toxicity testing, we had stated that the test samples should not be aerated to over 50% of saturation. At the permittee's request we have reconsidered, and determined it reasonable to change the upper limit to 60% of saturation.

In the 9/27/84 issuance we had also included a condition requiring the pH of each sample to be adjusted to that of the effluent. The permittee had challenged that requirement, suggesting that if pH adjustment was required it should be to that of the receiving waters. Since the toxicity limit is an effluent limit based on an effluent toxicity standard, we can not concur. Also, it is our position, based on consultation with FDER, that particularly for pulp and paper wastewater, if sample pH is not adjusted to that of the effluent, effluent toxicity could be impacted.

Other:

We are proposing to change the sample type on outfall 001 for zinc and (unionized) ammonia from grab to composite.

c. Best Management Practices (BMP):

Part IV of the proposed permit requires development and implementation of a BMP plan to prevent and control spills of toxic or hazardous substances listed under Sections 307(1)(1) and 311 of the Clean Water Act that may reach surface waters or upset the wastewater treatment process. The following toxic or hazardous substances are normally used at unbleached kraft mills such as the Alton facility:

Chlorine
Sodium Hydroxide (caustic Soda)
Sulfuric Acid
Aluminum Sulfate

A BMP plan requirement is proposed to be incorporated into this permit under the authority of Sections 304(3) and 402(a)(1) of the Clean Water Act.

The proposed permit condition will also state that if EPA should determine the permittee's BMP plan to be ineffective, specific changes to the BMP plan or BMP abatement measures can only be required by permit modification.

d. Toxicity Control

A toxicity screening was performed on the effluent quality informaton provided in Alton's NPDES application. As a result of the screening, the following parameters were considered further:

EFFLUENT CHARACTERISTICS	REPORTED VALUES (MAX DAILY) lb/d	mg/l	FL WQS (MARINE) mg/l
Copper	1.86	.04	.015
Nickel	5.63	.12	.10
Aluminum	229.9	4.9	1.5
Iron	56.3	1.2	.30

Concentrations of Aluminum, Nickel, Iron, and Copper in the effluent were found to be in excess of Florida Water Quality Standards for Class III marine waters, but since the criteria of FAC 17-3 is based on instream concentrations, and the discharge is into the St. John's River, the dilution factor is expected to be large; so instream chronic toxicity is not indicated from these parameters. A further review of toxicity testing that was conducted at the Alton site by the Florida DER and the EPA is summarized below. In addition, a biological impact analysis, titled "Review of Mill Effluent Impact on St. John's River", November, 1974, by Reynolds, Smith and Hills, Inc.; found no measurable biological impacts due to the effluent discharge.

Sept. 9-11, 1981	DER	A static acute bioassay was performed with *Mysidopsis bahia*. A 48 hour LC_{50} of 15.7% was calculated. Chemical analyses indicated unionized ammonia may be the source of the toxicity problem.
March, 1982	DER	The effluent was found to be toxic, but due to the high BOD_5 values, DO was depressed to the point which may have caused mortality in *Mysidopsis bahia*. Test invalidated as a result.
July 14-16, 1982	DER	*Daphnia pulex*: mortality indicated, but test invalidated due to low DO. *Mysidopsis bahia*: 48 hour LC_{50} of 141.7%. Chemical analysis: unionized NH_3, unidentified organics, As, Cd, Cr, Cu, Pb, Zn, Hg, Se. A 600 foot mixing zone was established and the Florida permit required additional semi-annual toxicity testing.
May, 1983	DER	*Mysidopsis bahia*: 30% kill in 100% effluent, 48 hours, no LC_{50} calculated. *Heterandia formosa*: no mortality. Chemical analysis: None.
March 27-29, 1984	DER	*Daphnia pulex*: static, 25% kill in 100% effluent in 24 hours. *Mysidopsis bahia*: 24 hour LC_{50} of 87.7%. *Notropis leedsi*: 10% kill in 100% effluent, 24 hours. Chemical analysis: unionized NH_3, unidentified organics, terpene, oil, As, Cu, Cd, Hg, Se. Report suggests a synergistic action of chemicals.
Sept. 19, 1982	EPA	Static 24 hour bioassay on macroinvertabrates and fish, no toxicity indicated (10% mortality in 100% effluent).
April 4, 1984	EPA	*Mysidopsis*: 48 hour static bioassay, 15% mortality in 100% effluent (not toxic). *Daphnia*: one 44 hour static bioassay-no lethality, one 24 hour static bioassay-7% mortality in 100% effluent. 96 hour flow-through bioassay on minnows, no toxicity. Chemical analysis: none.

The above tests suggest that there is a possibility of a toxicity problem with the effluent from outfall 001. A synergistic action of various chemicals may be the cause of the problem, as toxicity is indicated even when toxic levels for the various chemicals have not been exceeded. Also, due to the low D.O. content of the effluent, to avoid mortality in toxicity tests, aeration had to be performed. This drives off CO_2, raising the pH of the effluent, and perhaps neutralizing the toxic effects of the effluent's most toxic components (abedic acid) (Landon Ross, FDER). A basis for requiring an effluent limitation for toxicity on outfall 001 has been established by the above toxicity tests, the previous DER toxicity monitoring requirement in its operating permit, #IT-16-182, and in consideration of F.A.C 17-3.051(1)(d-f), 17-3.061(2)(p), and 17-4.244(4), as a reasonable suspicion of toxicity exists. The effluent limitation imposed is:

The effluent shall not be lethal to more than 50% of the mysid shrimp (*Mysidopsis bahia*) in a 96 hour static test (96 hour LC_{50}).

Proposed monitoring requirements can be found in the attached page I-2 of the draft permit.

This effluent limit is incorporated into the proposed permit in accordance with Section 301(b)(1)(c) of the Clean Water Act and the implementing regulations 40 CFR 122.44(C)(5). (See additional discussion on compliance schedules in Part 6 of this fact sheet.)

5. REQUESTED VARIANCES OR ALTERNATIVES TO REQUIRED STANDARDS

N/A

6. EFFECTIVE DATE OF PROPOSED EFFLUENT LIMITS, AND COMPLIANCE SCHEDULE (IF APPLICABLE):

All permit limits will be effective immediately on permit issuance.

The historical DMR data, consisting of approximately 27 months of data was reviewed and statistics compiled on it (facilitated by the use of the Agency's PCS system and the SAS package for statistics). The previous permit limits, new limits, their respective distributions, (the best distribution was picked, all probabilities that the distribution was accurate were greater than 50%), and the probability that the permit (both old and new) will be exceeded is listed below:

FL-3

EXCERPTS FROM

PERMIT NO. FL 0003051

Example of Permit with Chronic Limit

Permit No. FL0003051

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IV
345 COURTLAND STREET
ATLANTA, GEORGIA 30365

AUTHORIZATION TO DISCHARGE UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Clean Water Act, as amended (33 U.S.C. 1251 et. seq; the "Act"),

Jacquin - Florida Distilling

is authorized to discharge from a facility located at

425 Recker Highway
Auburndale, Florida

to receiving waters named

Lake Lena Run

in accordance with effluent limitations, monitoring requirements and other conditions set forth in Parts I, II, and III. The permit consists of this cover sheet, Part I 2 page(s), Part II 15 page(s), Part III 1 and Part IV 1 page(s).

This permit shall become effective on November 1, 1985.

This permit and the authorization to discharge shall expire at midnight, October 31, 1990.

September 20, 1985
Date Signed

Bruce R. Barrett
Bruce R. Barrett, Director
Water Management Division

PART I

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

1. During the period beginning on the effective date and lasting through expiration, the permittee is authorized to discharge from outfall serial number 001/002, process wastewater, cooling water and sanitary wastewater.

Such discharges shall be limited and monitored by the permittee as specified below:

PARAMETER	DISCHARGE LIMITATIONS				MONITORING REQUIREMENTS	
	kg/day Daily Avg	(lb/day) Daily Max	Other Units (Specify) Daily Avg	Other Units (Specify) Daily Max	Measurement Frequency	Sample Type
Flow, M³/Day (MGD)	-	-	-	-	Daily	Recorder
Temperature	-	-	95°F	100°F	1/Week	In-Situ
BOD$_5$						
Nov. 1 - March 31	-	-	22 mg/l	44 mg/l	1/Week	24-Hr. Composite
April 1 - Oct. 31	-	-	13 mg/l	26 mg/l	1/Week	24-Hr. Composite
TSS	-	-	24 mg/l	48 mg/l	1/Week	24-Hr. Composite
Fecal Coliform	-	-	200/100 ml	400/100 ml	1/Week	Grab
NH$_3$(as N)	-	-	1.0 mg/l	2.0 mg/l	1/Week	Grab
Dissolved Oxygen shall not be less than 6.0 mg/l					1/Week	Grab

The pH shall not be less than 6.0 standard units nor greater than 8.5 standard units and shall be monitored once per week by grab sample.

The effluent (44%) shall not be chronically toxic to, or produce adverse physiological or behavioral responses in, aquatic animals (reference FAC 17-3.061(2)(p)). Compliance with the chronic toxicity requirement shall be accomplished by demonstrating no difference as defined in Part IV, Section 2 of this permit, in reproduction and survival between appropriate test organisms exposed to an appropriate control water and 44% effluent. Failure to demonstrate compliance with the chronic toxicity requirement will constitute a violation of the terms of this permit.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

Part IV

Toxicity Control and Biomonitoring Program

In order to comply with Part I of this permit, the permittee shall provide existing toxicity data and perform toxicity tests that provide information on the possible toxic effect of the discharge from outfall(s) 001/002.

1. The permittee shall submit any existing toxicity data for review by EPA within 30 days of the effective date of this permit.

2. The permittee shall initiate the following series of tests within 60 days of the effective date of this permit to evaluate wastewater toxicity. The permittee shall conduct a 7-day *Ceriodaphnia* sp. life cycle test on 44% effluent using protocols provided by the EPA Environmental Services chronically toxic. Such testing will determine if 44% effluent affects the survival and reproduction of the test organisms. Such testing will be demonstrated if: 1) there is a 20% or more difference in survival effluent; or 2) there is a statistically significant difference at the 95% confidence level in reproduction between test organisms exposed to an appropriate control water and 44% effluent.

3. a. Such chronic toxicity tests shall be conducted once every two months during process season for a period of one year and once every process season during anticipated peak production thereafter. If any one test during this period indicates the presence of chronic toxicity, then another confirmatory chronic toxicity test will be conducted within 2 weeks. If this confirmatory test indicates the presence of chronic toxicity, then the providions of Section 3b shall apply. If no chronic toxicity is indicated in this confirmatory test, then the provisions of Section 3b will not apply. The results of each toxicity test shall be submitted to EPA concurrent with monthly discharge monitoring reports.

   b. If the presence of chronic toxicity is indicated, this will constiture a violation of Part I of this permit. The permittee will then be subject to the enforcement provisions of the Clean Water Act.

4. All quality assurance criteria used shall be in accordance with *Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms*, EPA-600/4-85-013 and *Methods and Quality Assurance for Performing Acute Toxicity Tests*, FDER Biological Section, 1985. All tests organisms and procedures used shall be in accordance with *Methods For Estimating the chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms, Section 12; Ceriodaphnia Survival and Reproduction Test Method 702.0*, EPA-600/4-85-014, Draft 5/1/85. The selection of an appropriate control water for the toxicity tests shall be submitted to EPA for review and approval prior to use.

November [illegible] - March [illegible]

[illegible] WTP BOD_5 = 20 mg/l, Ammonia = 2 mg/l, and D.O. = 6 mg/l
Coca Cola WTP BOD_5 = 20 mg/l, Ammonia = 1 mg/l, and D.O. = 6 mg/l
Jacquins WTP BOD_5 = 22 mg/l, Ammonia = 1 mg/l, and D.O. = 6 mg/l

If the State of Florida certifies a no discharge condition as part of the certification process, then the permit will be denied. In such case, the burden of proof to defend the no-discharge constraint will rest with the state.

Additionally, EPA is requiring chronic toxicity testing of the three industrial process discharges to Lake Lena Run. Prior testing of citrus process discharges to streams of low available dilution (low flow) has indicated a potential for chronic toxicity. Since the process discharges are all within 0.7 miles of each other, and since the testing is for an in-stream chronic conditions, the companies will be allowed to dilute their effluent at a ratio that will simulate those instream conditions. At the modeled design run, the process water total stream flow ratio was 6.8 mgd process water flow: 15.5 mgd stream flow, or a 44% dilution factor. See Part IV of the individual permits for specific requirements.

Temperature and fecal coliform effluent limitations are the same as in the previous NPDES permit. The total suspended solids effluent limitations are based on Florida Department of Environmental Regulation permit number IC53-62261, expiration date April 8, 1988.

6. THE ADMINISTRATIVE RECORD, including application, fact sheet and/or draft permit, comments received, and additional information on hearing procedures is available by writing the EPA address above, or for review and copying at 345 Courtland Street, N.E., 3rd Floor, Atlanta, Georgia 30365, between the hours of 8:15 A.M. and 4:30 P.M., Monday through Friday. Copies will be provided as a cost of 20¢ per page.

7. RESULTS OF STATE CERTIFICATION

State certification is pending.

8. REFERENCES AND CITED DOCUMENTS

All materials and documents referenced or cited in this fact sheet are either a part of the Administrative Record as described in item 7 or are readily available at EPA, Region IV. Information regarding these materials may be obtained from the person listed below.

9. EPA Contact

Additional information concerning the permit may be obtained at the address and during the hours noted in item 6, from:

Mrs. Earline Hanson
404/881-4316

FL-4

EXCERPTS FROM

PERMIT NO. FL 0026042

Permit No. FL00[illegible]4.

Example of Permit With Chronic Limit

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION IV
345 COURTLAND STREET
ATLANTA, GEORGIA 30365

AUTHORIZATION TO DISCHARGE UNDER THE NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Federal Water Pollution Control Act, as amended, (33 U.S.C. 1251 et. seq.; the "Act"),

United Technologies Corporation
Pratt and Whitney Aircraft
Government Products Division

is authorized to discharge from a facility located at

State Road 710 - Beeline Highway
Palm Beach County, Florida

to receiving waters named

Ditch to C-18 Canal to Loxahatchee River

in accordance with effluent limitations, monitoring requirements and other conditions set forth in Parts I, II, III, IV and V hereof. The permit consists of this cover sheet, Part I _3_ page(s), Part II _15_ page(s), Part III _1_ page, Part IV _2_ page(s) and Part V _2_ page(s).

This permit shall become effective on November 1, 1984.

This permit and the authorization to discharge shall expire at midnight,

October 31, 1989.

September 27, 1984
Date Signed

Paul J. Traina, Director
Water Management Division

PART I

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

1. During the period beginning on the effective date of this permit and lasting through the term of this permit, the permittee is authorized to discharge from outfall serial number 003, present and future sources of various wastewaters uncontaminated by the manufacturing process, including but not limited to non-contact cooling water, cooling tower blowdown, boiler blowdown, treated sanitary wastewaters, stormwater runoff and the many miscellaneous contributions to the Site Industrial Canal. All future wastewater sources must be of the types identified here and in the NPDES application for this outfall. EPA and FDER shall be notified in advance of start-up of any future sources.

Such discharges shall be limited and monitored by the permittee as specified below:

EFFLUENT CHARACTERISTIC	DISCHARGE LIMITATIONS				MONITORING REQUIREMENTS	
	kg/day (lbs/day)		Other Units (Specify)			
	Daily Average	Daily Maximum	Daily Average	Daily Maximum	Measurement Frequency	Sample Type
Flow, M^3/Day (MGD)	-	-	-	-	1/Month	Instantaneous*
Total Suspended Solids	-	-	30 mg/l	45 mg/l	1/Month	Grab
Total Toxic Organics**	-	-	-	2.13 mg/l	1/Month	Grab
Temperature °C(°F)	-	-	35 (95)	38 (100)	1/Month	Grab

Toxicity Control and Biomonitoring Program - The effluent (100%) shall not be chronically toxic to, or produce adverse physiological or behavioral responses in, aquatic animals (reference FAC 17-3.061(2)(r)). Compliance with this requirement shall be accomplished by demonstrating no difference, as defined in Part V, Section 2 of this permit, in reproduction and survival between appropriate test organisms exposed to an appropriate control water and 100% effluent.

The pH shall not be less than 6.0 standard units nor greater than 8.5 standard units and shall be monitored once per month by grab sample.

There shall be no discharge of floating solids or visible foam in other than trace amounts.

* Instantaneous measurement will be the sum of the flow contributions going to the site canal discharge point as computed by actual measurements and/or pump rates. This flow measurement does not include a small stormwater runoff contribution downstream of flow measuring devices.

** The term "total toxic organics (TTO)" means the sum of the concentrations for each of the toxic organic chemicals, listed in 48 FR, No. 137, July 15, 1983, page 32485, which is found in the discharge at a concentration greater than ten (10) micrograms per liter. In lieu of monitoring for TTO, Respondent can certify compliance with the Solvent Management Plan dated July, 1984, submitted to EPA.

(Continued on next page)

Part V
Toxicity Control and Biomonitoring Program

In order to comply with Part I of this permit, the permittee shall provide existing toxicity data and perform toxicity tests that provide information on the possible toxic effect of the discharge from outfall(s) 003.

1. The permittee shall submit any existing toxicity data for review by EPA within 30 days of the effective date of this permit.

2. The permittee shall initiate the following series of tests within 60 days of the effective date of this permit to evaluate wastewater toxicity. The permittee shall conduct a 7-day Ceriodaphnia sp. life cycle test on 100% effluent using protocols provided by the EPA Environmental Services Division (ESD) to determine if the discharge from outfall 003 is chronically toxic. Such testing will determine if 100% effluent affects the survival and reproduction of the test organisms. Such testing will be conducted on each of four grab samples of 100% effluent collected over a 24 hr. period in order to catch any peaks of toxicity and to account for diurnal variations in effluent quality. Toxic effects will be demonstrated if: 1) there is a 20% or more difference in survival between test organisms exposed to appropriate control water and 100% effluent; or 2) there is a statistically significant difference at the 95% confidence level in reproduction between test organisms exposed to an appropriate control water and 100% effluent. Results for each grab sample shall be reported. The results of each toxicity test shall be submitted to EPA concurrent with monthly discharge monitoring reports.

3. a. Such chronic toxicity tests shall be conducted once each month for 12 consecutive months. If any one test during this period indicates the presence of chronic toxicity, then another confirmatory chronic toxicity test will be conducted within two weeks. If this confirmatiory test indicates the presence of chronic toxicity, then the provisions of Section 4 shall apply. If no chronic toxicity is indicated in this confirmatory test, then the provisions of Section 4 will not apply. If any further monthly chronic toxicity test during the 12 month period following permit issuance indicates the presence of chronic toxicity, then the provisions of Section 4 shall apply.

   b. If these tests indicate that no wastewaters are being discharged in toxic amounts, subsequent chronic toxicity testing will be required only once every six months thereafter. If any such subsequent test indicates toxicity, a follow-up chronic toxicity test will be conducted within 2 weeks and monthly chronic toxicity testing shall resume for a minimum of 6 months. If chronic toxicity is indicated in the confirmatory test, then the provisions of Section 4 shall apply. If no toxicity is indicated in the confirmatory test but is revealed in any subsequent monthly test during the next 6 months, then the provisions of Section 4 shall apply. If no toxicity is indicated in the confirmatory test or in any subsequent monthly test, then chronic toxicity testing will be required once every 6 months thereafter.

If the presence of chronic toxicity is determined, the permittee will be required to chemically analyze a sample of 100% effluent collected during a period of high toxicity using a gas chromatographic screen and shall analyze for metals using atomic adsorption. The results and interpretation of this analysis shall be submitted to the EPA for review concurrent with the monthly discharge monitoring reports. After EPA review within 30 days, the permittee will be required to test for the presence of those compounds considered to be bioaccumulative by EPA based on the results of the GC screen by analyzing and comparing fish or mussel tissue samples collected from downstream areas and upstream areas or an adjacent unaffected body of water similar to the receiving stream. If downstream concentrations of a particular compound exceed upstream or adjacent unaffected water concentrations by a factor of five or more, then that compound shall be considered to be bioaccumulative. Exposure by test organisms, whether fish or mussels, shall be for a minimum period of 30 days in such bioaccumulative tests. Results of the bioaccumulation testing shall be submitted to the EPA within 30 days of the finalization of test results.

5. If these results indicate that the wastewaters are discharged in toxic amounts or contain bioaccumulative pollutants, the permittee shall submit to the EPA a toxicity control plan and accompanying implementation schedule within 90 days of the finalization of the chronic toxicity test results or the bioaccumulation study results. The control plan shall include appropriate measures such as in-plant controls (process, raw material, or product changes), additional wastewater treatment, or changes in the operation of the facility to reduce the toxicity of the wastewater discharge to acceptable levels. Depending on the complexity of the problem, the timing of the plan submitted and the implementation schedule may be negotiable.

6. Once the control plan has been fully implemented, periodic biological monitoring will be required to assure continued control of toxicity.

7. All quality assurance criteria used shall be in accordance with *Methods for Measuring the Acute Toxicity of Effluent to Aquatic Organisms*, EPA-600/4-78-012 and *Quality Assurance Manual for Performing Acute Toxicity Tests*, FDER Biological Section, 1983. All test organisms and procedures used shall be in accordance with the protocols for the 7-day *Ceriodaphnia* sp. life cycle test as provided by EPA ESD. The selection of an appropriate control water for the chronic toxicity tests shall be submitted to the EPA for review and approval prior to use.

The company has stated that the presence of certain pollutants in the final discharge is a result of the background levels of the incoming waters. Therefore, rather than place specific limits on this discharge for cadmium, chromium, copper, lead, nickel, silver, zinc, cyanide and residual chlorine, we have developed a toxicity control and biomonitoring program (See Attachment C) as a permit requirement which will ensure these pollutants are not discharged in toxic concentrations or amounts. The effluent (100%) shall not be chronically toxic to, or produce adverse physiological or behavioral responses in, aquatic animals (reference FAC 17-3.061(2)(p)).

The limits for total suspended solids, temperature and pH are the same as required in the previous NPDES permit. The total toxic organics (TTO) limit is taken from the Electroplating and Metal Finishing Point Source Categories Effluent Guidelines, FR 48, No. 137, Friday, July 15, 1983, Subpart A - Metal Finishing, Section 433.14. The term "total toxic organics" (TTO) means the sum of the concentrations for each of the toxic organic chemicals listed below and which is found in the discharge at a concentration greater than ten (10) micrograms per liter:

Acenaphthene
Acrolein
Acrylonitrile
Benzene
Benzidine
Carbon tetrachloride (tetrachloromethane)
Chlorobenzene
1.2.4-trichlorobenzene
Hexachlorobenzene
1.2.-dichloroethane
1.1.1-trichloroethane
Hexachloroethane
1.1-dichloroethane
1.1.2-trichloroethane
1.1.2.2-tetrachloroethane
Chloroethane
Bis (2-chloroethyl) ether
2-chloroethyl vinyl ether (mixed)
2-chloronaphthalene
2.4.6-trichlorophenol
Parachlorometa cresol
Chloroform (trichloromethane)
2-chlorophenol
1.2-dichlorobenzene
1.3-dichlorobenzene
1.4-dichlorobenzene
N-nitrosodi-n-propylamine
Pentachlorophenol
Phenol
Bis (2-ethylhexyl) phthalate
Butyl benzyl phthalate
Di-n-butyl phthalate
Di-n-octyl phthalate
Diethyl phthalate
Dimethyl phthalate
1.2-benzanthracene (benzo(a)anthracene)
Benzo(c)pyrene (3.4-benzopyrene)
3.4-Benzofluoranthene (benzo(b)fluoranthene)
11.12-benzofluoranthene (benzo(k)fluoranthene]
Chrysene
Acenaphthylene
Anthracene
1.12-benzoperylene (benzo(ghi)perylene)
Fluorene
Phenanthrene
1.2.5.6-dibenzanthracene (dibenzo(a.h)anthracene
Indeno(1.2.3-cd) pyrene (2.3-o-phenlene pyrene)
Pyrene
Tetrachloroethylene
Toluene
Trichloroethylene
Vinyl chloride (chloroethylene)
3.3-dichlorobenzidine
1.1-dichloroethylene
1.2-trans-dichloroethylene
2.4-dichlorophenol
1.2-dichloropropane (1.3-dichloropropene)
2.4-dimethylphenol
2.4-dinitrotoluene
2.6-dinitrotoluene
1.2-diphenylhydrazine
Ethylbenzene
Fluoranthene
4-chlorophenyl phenyl ether
4-bromophenyl phenyl ether
Bis (2-chloroisopropyl) ether
Bis (2-chloroethoxy) methane
Methylene chloride (dichloromethane)
Methyl chloride (chloromethane)
Methyl bromide (bromomethane)
Bromoform (tribromomethane)
Dichlorobromomethane
Chlorodibromomethane
Hexachlorobutadiene
Hexachlorocyclopentadiene
Isophorone
Nephthalene
Nitrobenzene
2-nitrophenol
4-nitrophenol
2.4-dinitrophenol
4.6-dinitro-o-cresol
N-nitrosodimethylamine
N-nitrosodimethylamine
Aldrin
Dieldrin
Chlordane (technical mixture and metabolites)
4.4-DDT
4.4-DDE (p.p-DDX)
4.4-DDD (p.p-TDE)
Alpha-endosulfan
Beta-endosulfan
Endosulfan sulfate
Endrin
Endrin aldehyde
Heptachlor
Heptachlor epoxide (BHC-hexachlorocyclohexane)
Alpha-BHC
Beta-BHC
Gamma-BHC
Delta-BHC
(PCB-polychlorinated biphenyls)
PCB-1242 (Arochlor 1242)
PCB-1254 (Arochlor 1254)
PCB-1221 (Arochlor 1221)
PCB-1232 (Arochlor 1232)
PCB-1248 (Arochlor 1248)
PCB-1260 (Arochlor 1260)
PCB-1016 (Arochlor 1016)
Toxaphene
2.3.7.8-tetrachlorodibenzo-p-dioxin (TCDD

In lieu of monitoring for these parameters, the permittee can certify that no dumping of concentrated toxic organics has occurred and compliance with a solvent management plan.

APPENDIX E

ISSUES AND RESPONSES: WHOLE-EFFLUENT TOXICITY LIMITS

Whole-effluent toxicity limits play an important role in the proposed system discussed in the main report. To help assist in the understanding of these limits, a series of issues and responses is presented in this appendix for five types of concerns relating to whole-effluent limits:

- o the rationale for whole-effluent limits;
- o the legislative authority for implementing whole-effluent limits;
- o the scope of toxicity testing;
- o perceived testing problems;
- o the selection of test species.

These issues and responses are drawn, in part, from State of New Jersey responses to issues raised by Ciba-Geigy Corporation on toxicity requirements[1], and from questions and responses prepared by the U.S. EPA in anticipation of questions by permittees on the use of toxicity testing in the U.S. NPDES permits program[2].

Rationale for Whole-Effluent Toxicity Limits

Issue:	The effluent toxicity standard is an extreme limit unnecessary to protect the biota of the receiving waters.
Response:	The intent of the effluent toxicity standards is to ensure that the general provision of the Environmental Protection Act preventing the "discharge of a contaminant into the natural environment that causes or is likely to cause impairment of the quality of the natural environment for any use that can be made of it [or] causes or is likely to cause injury ... to plant or animal life" is met.

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[1] State of New Jersey Department of Environmental Protection. ca1986. Response to CIBA-GEIGY Corporation Comments on Bioassay Requirements. Prepared and submitted by Monitoring and Planning Element, Division of Water Resources.

[2] Hanmer, R.W. 1985. Expected questions by permittees on the use of toxicity testing in the NPDES permits program. Memorandum to regional water management division directors dated 5 December. U.S. EPA Office of Water Enforcement and Permits.

In addition, it is also suitable for ensuring that "at no point [in a mixing zone] should conditions be immediately lethal so that swimming organisms cannot evade the area ... [nor should the mixing zone be] allowed to become an area where aquatic life is killed or seriously damaged" in accordance with the Bluebook. The effluent standard establishes a uniform minimum toxicity for all the dischargers in the province.

Issue: The whole effluent approach is redundant given the technology-based requirements of MISA, especially where there is not an exceedance of the Water Quality Objectives.

Response: The Environmental Protection Act provides a "narrative water quality standard" prohibiting the discharge of toxic pollutants in toxic amounts. In this regard, it is quite similar to U.S. practice which follows the principles of the Clean Water Act. However, analysis of the toxicity of effluents over the past several years by States and EPA have revealed that a significant number of effluents exhibit toxicity at such high levels that receiving waters are impacted. This is found to be true even where technology-based requirements and State numerical criteria for certain toxicants are being met by permittees. Thus, the narrative standards are not being met in many cases.

Toxicity testing is the only way to assess whether or not certain effluents, particularly those containing many potentially toxic pollutants, when discharged in combination result is a toxic effect to the receiving ecosystem. Therefore, toxicity testing is being used in conjunction with more conventional pollutant-specific control procedures to regulate the discharge of toxic pollutants.

The science of aquatic toxicology is not a new or recently invented one. Its application has been focussed on analyzing single pollutants in the past. This has changed with the development of short-term, inexpensive, and relatively simple toxicity tests and the procedural guidance necessary to use them.

Toxicity testing provides the potential to help ensure that environmental protection objectives are being met. It extends the assurances provided by technology-based controls and chemical-specific limits. With the development of practical tools, this approach is now reasonable, reliable and accurate.

Issue: STPs with an approved treatment program do not need toxicity testing requirements.

Response: Even in a well-operated STP with an extensive sewer use control program, all the toxicants in complex effluents cannot be measured or limited. Toxicity testing provides a method for limiting the total effluent toxicity, where necessary, so that water quality goals can be met. It can also be used to identify other pollutants of concern so that specific local limits or other controls can be developed. Whole effluent testing is particularly useful to understand the environmental implications of complex effluents discharged from STPs.

Where pass-through problems at STPs are demonstrated, additional controls on indirect discharges can be introduced or other corrective actions can be taken to meet water quality objectives.

Issue: Effluent toxicity is not directly related to impact to receiving waters. The toxicity of an effluent to certain laboratory test organisms is a poor predictor of instream impact.

Response: The U.S. EPA Office of Water initiated a multi-year research effort called the Complex Effluent Toxicity Testing Program to address this question. The study selected a number of water quality-impacted sites around the United States, conducted extensive biosurveys, calculated instream concentration isopleths, and compared the results to measured effluent toxicities. The studies show that when exposure is adequately assessed, effluent toxicity correlates directly to instream impact.

Where an effluent is found to be toxic at a certain concentration using standard toxicity tests, and that concentration is exceeded instream, a toxic effect can be expected in the receiving water.

Issue: There is an absence of toxicity treatability data and a lack of toxicity reduction procedures, and therefore dischargers will not be able to achieve compliance with toxicity-based limits.

Response: There are two approaches to Toxicity Reduction Evaluations (TREs). First, toxicity can be used as a control parameter itself. Bench scale treatability studies can then be conducted to see which treatment train best controls toxicity. Second, toxicity tests can be used as detective tools to see what specific toxicants are causing toxicity.

The U.S. EPA's Office of Research and Development has been investigating effluent toxicity using both of these approaches. Several documents which describe individual industrial categories and potential sources of toxicity in them have been released. Reports on the leather tanning, pulp and paper, organic chemical, textile and petroleum refining categories are available. Toxicity reduction procedures for STPs have also been prepared.

Experience of regulatory authorities and the regulated community has indicated that toxicity treatment is achievable often by relatively simple and inexpensive methods. Toxicity reduction requirements have been included in a number of U.S. permits with successful results. North Carolina used toxicity testing to flag toxic impacts due to the discharge of organotin compounds from textile mills.

Authority to Implement the Whole-Effluent Approach

Issue: There is no regulatory authority for establishing toxicity testing requirements and toxicity-based permit limits.

Response: Such authority is provided in the Ontario Water Resources Act:

> OWRA s.44(1)(h): Subject to the approval of the Lieutenant Governor in Council, the Minister may make regulations prescribing standards of quality for potable and other water supplies, sewage and industrial waste effluents, receiving streams and water courses.
>
> OWRA s.24(4): Where in the opinion of a Director it is in the public interest to do so, the Director may refuse to grant his approval [of sewage works] or grant his approval on such terms and conditions as he considers necessary.

Scope of Toxicity Testing

Issue: Toxicity testing is not a valid way to control toxic pollutants and is not an acceptable substitute to the control of individual toxic pollutants.

Response: Toxicity testing may be the only way to limit the discharge of toxic pollutants in some discharge situations, particularly where numerical standards are absent or effluents are discharged which contain complex mixtures of toxicants.

Setting controls for toxicants requires an integrated process utilizing both chemical-specific and toxicity-based approaches. Toxicity testing does not replace the chemical-specific controls. The technique is to be used to measure and limit whole effluent toxicity and to augment chemical controls where necessary.

Issue: The effluent toxicity standard is not an appropriate means of dealing with concerns over chronic toxicity or bioaccumulation, and should not be used for those purposes.

Response: There are two appropriate regulatory uses of acute toxicity tests: the effluent toxicity standard and water quality-based whole effluent toxicity limits. These requirements are separate but complementary requirements, much like technology-based and water quality-based limits for a particular chemical parameter. The equation for deriving a water quality-based whole effluent toxicity limit may include an application factor, in order that the limit protect against chronic toxicity, as well as acute toxicity. Direct use of chronic testing with water quality-based whole effluent toxicity limits may also be used.

The effluent toxicity standard has no relation to any chronic toxicity limit, nor is it intended to deal with bioaccumulation.

Issue: Toxicity testing does not address bioaccumulation and human health problems.

Response: Controls for bioaccumulative and human health problem chemicals will continue to be based on chemical-specific control methods. Criteria and standards for such problem pollutants are being developed at this time on a chemical-specific basis. Also considerable progress is being made in developing a whole-effluent test for human health effects.

Testing Problems

Issue: The state of the art of toxicity testing has not progressed to the point where it is suitable for discharge-permit purposes.

Response: Numerous U.S. state governments have successfully utilized the whole effluent toxicity approach, based on toxicity testing, in their permitting processes for several years. In addition, the U.S. EPA has a national policy, entitled "Development of Water Quality-Based Permit Limitations for Toxic Pollutants" (49 FR 9016; March 9, 1984), which strongly supports the use of the whole effluent toxicity approach. This approach is being increasingly and successfully applied broadly in the U.S.

Issue: Toxicity testing is prohibitively expensive.

Response: Costs for toxicity testing are not excessive and will decrease as more testing is required. Although costs are very site specific, they typically run from several hundred dollars for simple screening tests to one or two thousand dollars per month for a monthly chronic toxicity analysis. Typical monthly or quarterly testing costs are comparable to other chemical monitoring costs:

Analysis (invertebrates or fish)	Cost
24 h static screening	$125-150
24 h or 48 h static acute	$300-450
96 h static acute	$325-450
7 d static chronic	$350-1000
21 d static chronic	$2500-3000

Issue: Allowance must be made for toxicity testing variability.

Response: Common practice is not to include a variability term in permitted effluent limits, and there is no reason to treat a toxicity limit any differently. Although there may be variability in acute toxicity data, the variability of these tests is as low as or lower than many commonly accepted chemical analytical methods.

Issue: Field testing should be used instead of laboratory toxicity testing.

Response: As is the case with any other type of water quality limits, compliance for acute toxicity is measured at the control point using a standardized test methodology.

Issue: The use of a test of 96 h duration is inappropriate, since few species will remain consistently in the vicinity of the outfall for 96 h.

Response: One of the purposes of the effluent toxicity standard is to prevent significant acute mortality of aquatic biota from occuring in a mixing zone. It is recognized that motile organisms may not remain in the vicinity of an outfall for 96 h, but the organisms that the test species represent include sessile organisms which remain in place in the waterbody. In addition, an effluent with a 50% LC50 over a duration of less than 96 h may not meet the Bluebook guideline of ensuring that a mixing zone does not become an area where aquatic life is killed or seriously damaged. However, through the use of a 96 h test that requirement will generally be met because a 96 h LC50 often translates to little or no mortality within 24 to 48 h.

Issue: Dilution factors should be used instead of 50 per cent effluent standards.

Response: Dilution factors are used in the development of water quality-based whole effluent toxicity limits. These limits are a separate but complementary requirement to the effluent toxicity standard.

Selection of Test Species

Issue: When test species are chosen, are they always indigenous?

Response: No. Species used in a particular circumstance may not be indigenous, but may be chosen because the species was used extensively in the development of water quality criteria. The test species is chosen as the representative species considered to be most sensitive to the discharge.

Issue: The validity of acute toxicity tests on a single species for compliance of complex effluents has not been scientifically established.

Response: Multiple test species should be used during effluent screening, in order to determine which test species is the most sensitive to the effluent, but then only the most sensitive of the species is used for evaluating permit limits. Where multiple species test data are available, they can be used. However, in order to minimize the economic burden on dischargers of testing, multiple species testing is not generally required.

Issue: Picking the most sensitive species one can find is based on the conservative reasoning that if one can successfully protect the most sensitive species, then all others are also being protected. This overstates the toxicity to all the other species in the vicinity of the outfall.

Response: The appropriate test species is not the "most sensitive species one can find," but rather the most sensitive species representative of the aquatic biota of receiving waters. A healthy aquatic community generally consists of a large number of resident species with a wide range of sensitivities, whereas there are relatively few standardized test species. It is highly probable that there are resident species that are more sensitive than the most sensitive representative test species, so that regulators must select the most sensitive representative test species in order to protect the more sensitive resident species.